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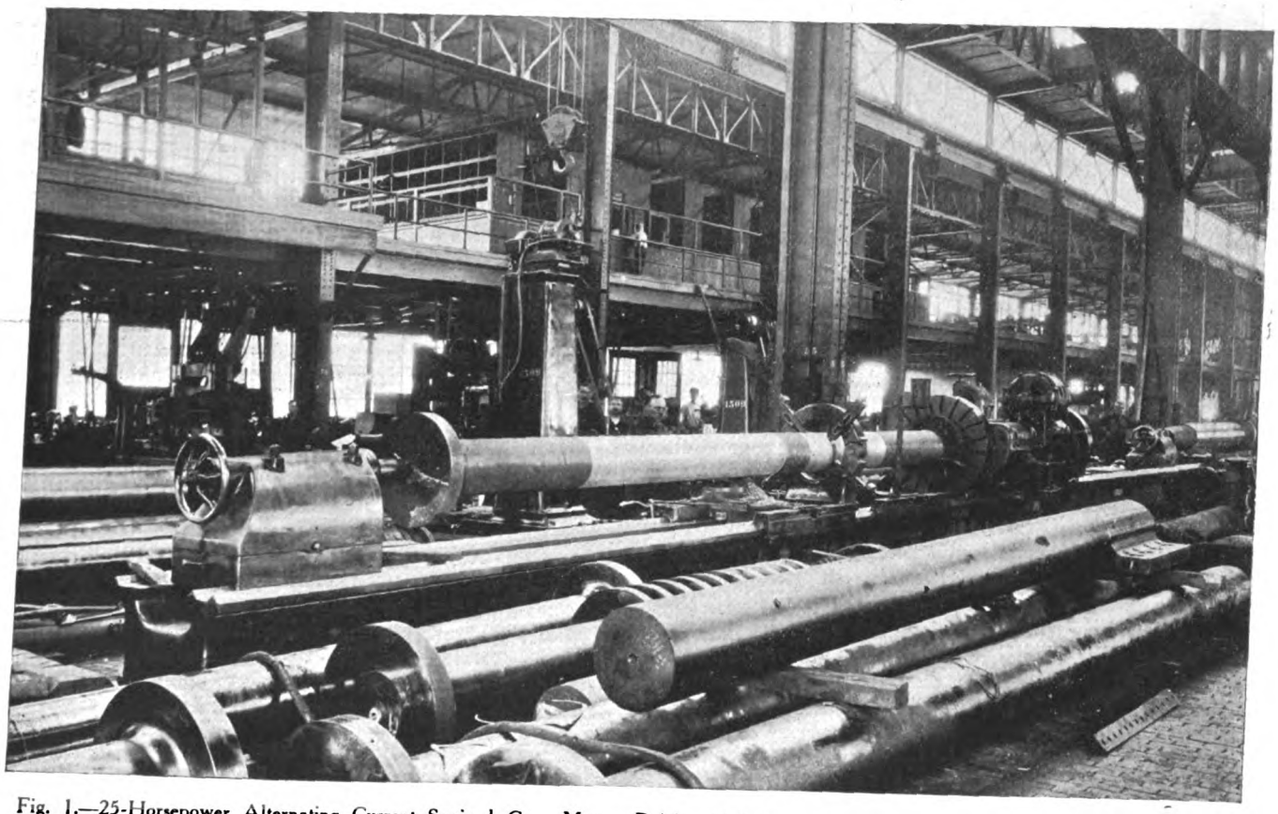

Fig. 1.—25-Horsepower Alternating Current Squirrel Cage Motors Driving 48-Inch Propeller-Shaft Lathes in Pennsylvania Shipyard

Electric Motors for Shipyard Machinery

Motors and Control Best Suited for Various Classes of Machinery—Circumstances Governing Choice of Motor—Individual vs. Group Drive

BY WILLIAM HARRISON, JAMES GOLDSBOROUGH AND WILLIAM H. EASTON*

THE electric motor is now universally regarded as the best form of drive for shipyard machinery, and its use for every possible power purpose is a matter of standard practice in the shipbuilding and repairing industry throughout the world.

But electric motor drive is satisfactory under one condition only: the motor and its controller must be perfectly suited to the driven machine; and since shipyard machines vary widely in their speed and power requirements, and since there are numerous types of motors, each with its own special electrical and mechanical characteristics, and each with several different methods of control, the selection of the proper electrical equipment for a given machine is not always an easy matter.

However, the field of application of each type of motor and control is quite definite, and if the limits of these fields are clearly recognized, the problem of motor selection becomes greatly simplified. It is, therefore, the purpose of this article to discuss the types of motors and controllers that can be used with each class of shipyard machinery and to indicate what equipment is best under given circumstances.

Direct Current Motors vs. Alternating Current Motors

The first point to be settled in laying out the electrical equipment of a shipyard is whether direct current or alternating current motors are to be used. Both have their advantages and both have their limitations. These must be carefully considered before a decision is made.

The chief feature of the direct current motor is that (for reasons explained later on) it is superior to any

* The authors of this article are connected with the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

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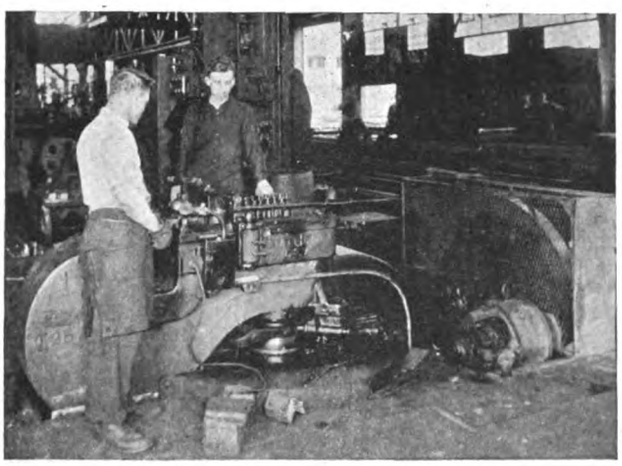

Fig. 2.—Direct Current Motor, With Push Button Control, Driving Horizontal Punch at Cramp's Shipyard

other form of power for driving adjustable speed machine tools, such as lathes, drills, etc. So great indeed is this superiority that no other power should be considered for use in the average machine shop. Direct current is also the only power that can be used for operating electric yard locomotives and for charging the batteries of the small electric trucks and tractors that are becoming increasingly popular in all industrial plants.

For driving practically all the other shipyard machines, however, alternating current motors are quite as satisfactory as direct current motors, and are generally preferred because they are simpler in construction and require somewhat less attention. Hence, they are used wherever possible.

But the chief feature of alternating current is that, because its voltage can be raised and lowered at will, it is the only form of power that can be economically transmitted long distances. Hence its use is practically compulsory when the transmission lines exceed about 1,000 feet in length.

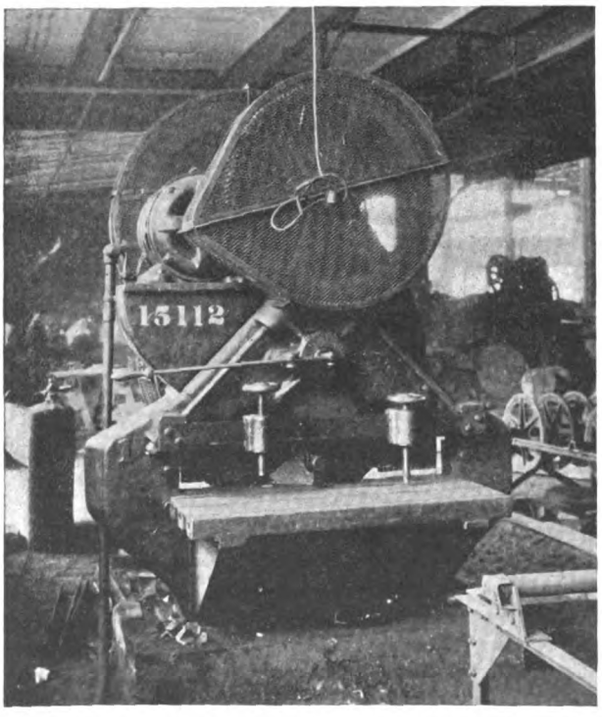

Fig. 3.—10-Horsepower Alternating Current Squirrel Cage Motor Geared to Angle Shears at Pennsylvania Shipyard

To sum up, small yards generating their own power should use direct current throughout. Large yards, on the other hand, should generate alternating current, use this power for practically everything except for the machine shop and for transportation, and, for these special purposes, generate a supplementary supply of direct current by means of rotary converters or motor generator sets (preferably the former, because they are more compact and efficient).

An increasing number of yards are buying power from central stations, instead of generating it themselves, because central station power is, in general, more economical, reliable and convenient than that produced in private plants. Central station power is almost invariably supplied in the form of alternating current, so that when it is used a supplementary supply of direct current is necessary.

If a shipyard having central station current available should for any reason generate its own power, its power should be the same as that of the central station, so as to be able to use the latter for breakdown service.

Individual vs. Group Drive

There are two methods of driving machines by means of motors:

1. Individual drive—a motor on each machine.
2. Group drive—several machines driven through line shafting and belts by a single motor.

Individual drive is, however, the only method used for practically all shipyard machinery, since group drive is only advantageous for compact groups of constant speed machines that are all engaged continuously in the same kind of work, and such groups are rare in shipyards. The data in the following text, therefore, apply only to individual drive, except when otherwise stated.

Motors for Adjustable Speed Machine Tools

By adjustable speed machine tools is meant such tools as lathes, drills, milling machines, shapers, planers and others that must be operated at different speeds in order to suit different kinds of stock.

From the standpoint of motor drive the most important requirements of these machines are the following:

1. The speed range must be sufficiently large to suit all ordinary work.
2. A large number of separate speed steps should be available.
3. The speed on each step must be constant regardless of the load.

As to the first requirement, a lathe, or other machine tool, that operates only at one speed would have a very limited usefulness. Fo rmany of the jobs that might come to it, its speed would be so high that it could not handle them at all, while for others its speed would be so low that its output would be too small to be economical. Consequently, for average machine shop service, where each machine must handle a variety of jobs, machine tools must have a range of speeds.

Secondly, the number of speed steps available on a machine has an important bearing on the amount of work it can turn out. If, for example, the tool has but three speeds—slow, medium and fast—these speeds would suit exactly only a small proportion of the jobs to be done, and most of the work would necessarily have to be run off at too low a speed (the next higher speed being unusable), so that production would suffer. But if the machine has, say, 19 speed steps, practically every job can be run off at its highest permissible speed and the machine can be pushed to its economical limit.

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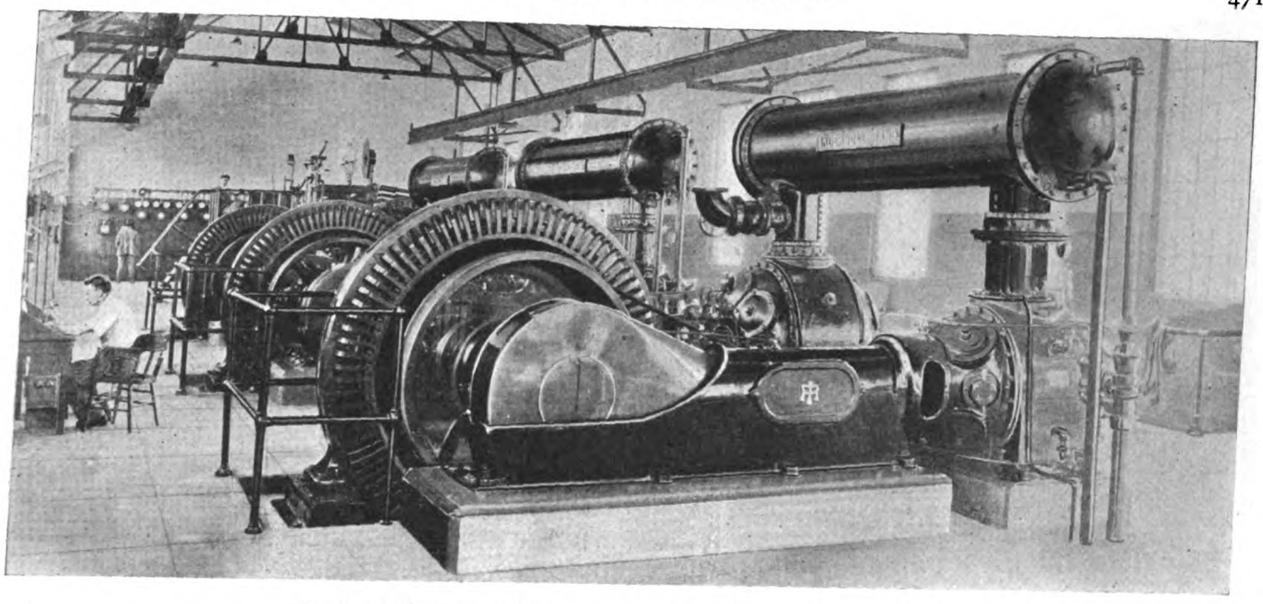

Fig. 4.—A Battery of Air Compressors Driven by Synchronous Motors

Finally, constant speed on each step is essential, since if the machine speeds up when running light and slows down when the cut is started, good workmanship becomes impossible.

Direct Current Motors.—It is because the shunt-wound, direct current motor admirably fulfills all these requirements that it is invariably used, wherever possible, for driving adjustable speed machine tools.

This type of motor can be obtained in sizes and speeds to suit all machine tools, and with windings for operation on all commercial voltages. Standard speed ranges are 1 to 2, 1 to 3, and 1 to 4 (for example, 750 to 1,500 revolutions per minute, 500 to 1,500 revolutions per minute, and 350 to 1,800 revolutions per minute), the last range being wide enough to suit the economical speed range of almost every machine tool. Full horsepower can be obtained on any speed.

These motors can be belted to machine tools intended for line shaft drive, but the modern machine tool is specially designed for motor drive, with the motor built into the machine, and the greater output of these machines, because of their properly selected speeds, conveniently located control, and their ability to take maximum cuts with high-speed steel tools, makes their use advisable under almost all circumstances.

Control.—The control of these motors consists of two

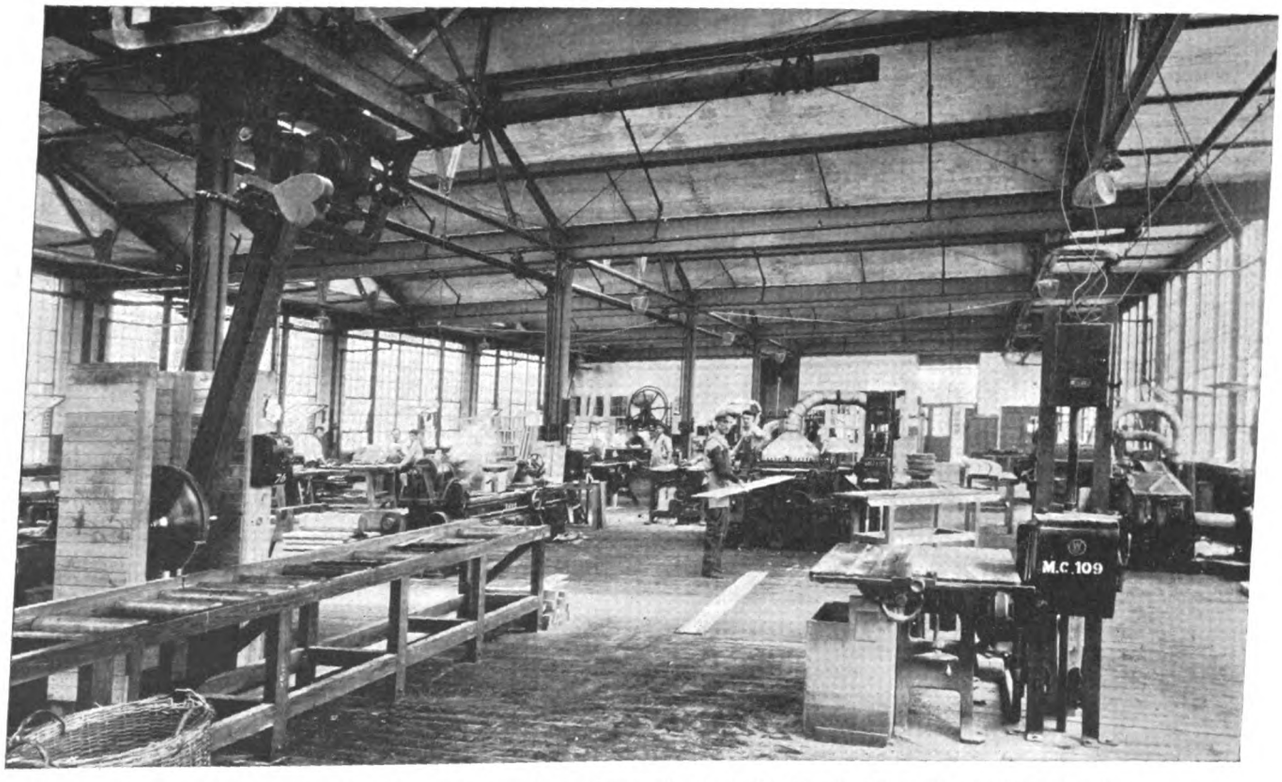

Fig. 5.—General View of Joiner Shop in Pennsylvania Shipyard. Each Machine is Driven by an Alternating Current Squirrel Cage Motor

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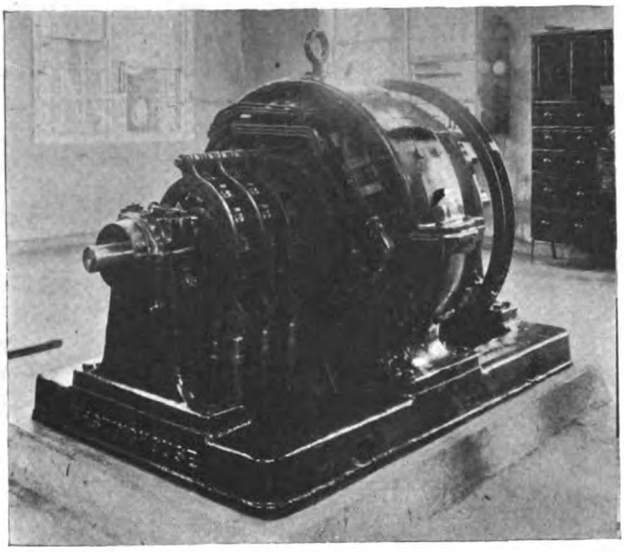

Fig. 6.—500-Kilowatt Rotary Converter for Transforming Alternating Current into Direct Current. New York Shipbuilding Corporation, Camden, N. J.

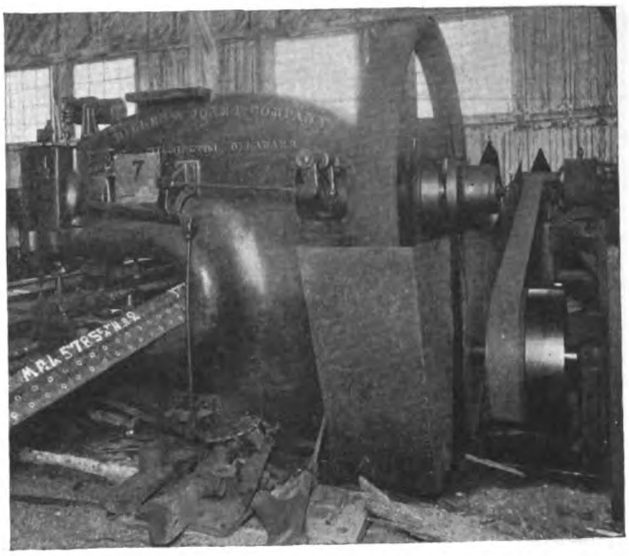

Fig. 8.—Direct Current Motor Belted to Punch. In the Old Shops of the Standard Shipbuilding Company, Shooter's Island, N. Y.

parts, the starting box and the speed regulator. The first, or the starting box, contains resistance connected in series with the motor armature and cut out in a series of steps so that the motor is gradually brought up to speed. If the motor were connected directly across the line without the use of a starter, it would either burn out or unduly stress the tool by starting too abruptly.

The speed regulator consists of resistance which is connected in series with the motor field circuit and is varied by turning a handle. By increasing this resistance the motor speed increases, so that the lowest speed of the motor is its normal speed, i. e., the speed with no resistance in the field circuit.

These two elements can be obtained mounted on the same panel and operated by a single handle, or they can be supplied separate, with the starter mounted near the motor, and the speed regulator on the machine tool convenient to the operator.

Ordinarily, they are both manually operated, but automatic control is becoming more and more widely used. With the automatic controller, the operator merely presses a button to start the machine and another to stop it. When the "start" button is pressed, the starting resistance is automatically cut out by a series of magnetically operated switches which bring the motor up to speed in the shortest time consistent with safety. This method saves a great deal of time, which means increased production, because the operator can control the motor without leaving his position, and without giving thought and attention to the proper operation of the starting box. It also saves damage to the starting resistance or to the motor, due to operating the starting box too slowly or too rapidly.

Usually, only the starter is automatic, the speed regulator being manually operated; but it is possible also to increase and decrease the speed of the machine by merely pushing buttons, and this is often desirable in the case of large machines.

Protection.—These controllers, as well as those used for the great majority of other motors, should furnish two kinds of automatic protection: (1) low voltage, and (2) overload.

The low-voltage device disconnects the motor from the line in case the power should fail, thus making it necessary to start the motor by means of the starting box when

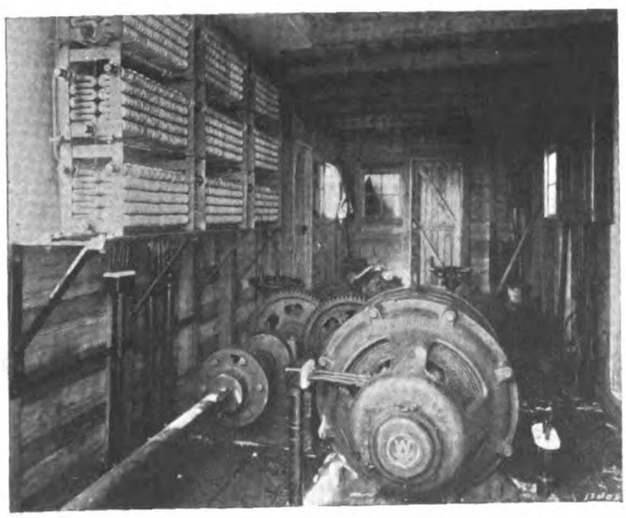

Fig. 7.—125-Horsepower Wound-Rotor Motor Driving 24 Pumps on Vulcan Iron Works Dry Dock

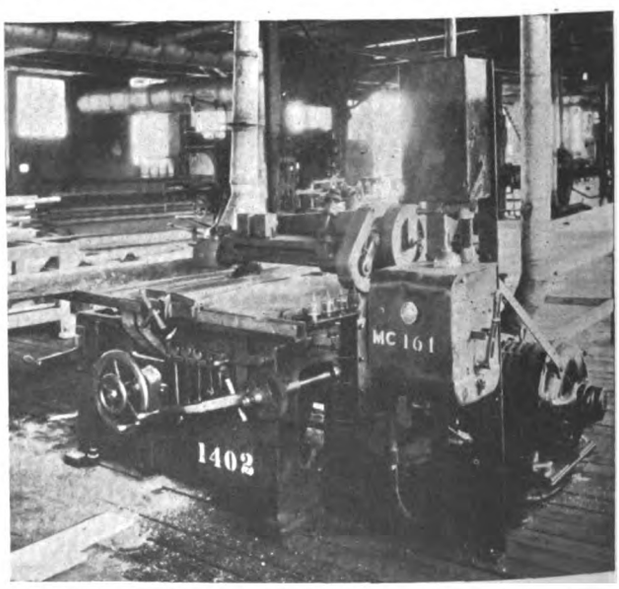

Fig. 9.—15-Horsepower Alternating Current Squirrel Cage Motor Driving Planer in a Shipyard

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the power returns. Otherwise the motor might burn out on the return of the current, or a machine might start up unexpectedly and injure someone. The device usually consists of a magnet that is energized by the line current and holds the handle of the starter in the "on" position against the force of a spring. When the current fails, the magnet releases its hold and the handle automatically returns to the "off" position.

Overload protection is essential to prevent the motor being overloaded and taking too great an amount of current, which would, of course, destroy it. It usually consists of a fuse or a circuit breaker which opens the circuit at a definite current valve and must be replaced or reset by hand.

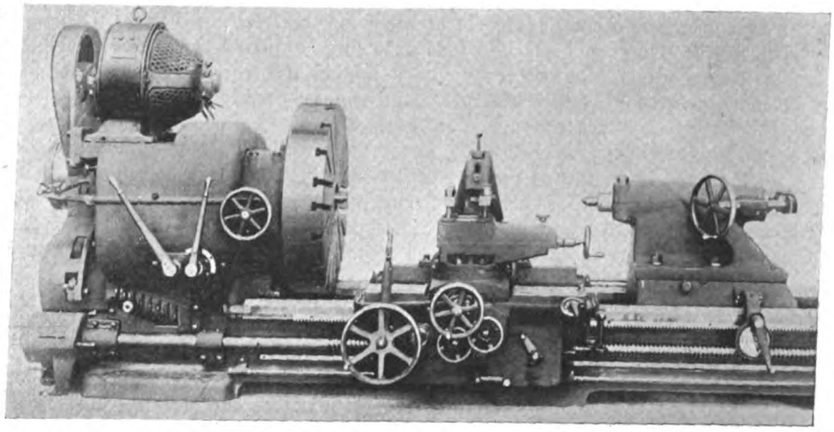

Fig. 11.—Modern Heavy Duty Lathe Especially Designed for Direct Current Motor Drive

Motors operating pumps and other machinery which are intended for continuous operation without constant attendance are frequently equipped with protection that is automatically reset when the trouble is eliminated, thus making a visit after a failure of power unnecessary.

Direct Current Planer Motors.—A special direct current motor has been designed for driving planers. It is directly connected to the machine and reverses at each stroke, so that the complication of belts and pulleys necessary with the older type of drive is eliminated. The cutting speed and the return speed can be adjusted independently, and as a wide variety of speeds is available, maximum production can be obtained from the planer.

The motor is especially designed throughout, as the service is very severe. The control is of the automatic type, with a manually operated speed regulator; and in order to facilitate setting up the work, a push button switch attached to a flexible cable is supplied, by means of which the operator can start, stop, "inch" or reverse the platen from any point around the machine.

Alternating Current Motors.—Though there are variable-speed alternating current motors, they are not suitable for operating machine tools, because their speeds (especially the reduced speeds) vary with the load. Consequently when alternating current only is available, machine tools should be driven by constant speed motors and the speed changes produced by mechanical means.

As compared with the use of direct current motors, this method of drive is unsatisfactory because it involves complicated systems of belts, shafting and pulleys, and also provides but a few speeds, so that maximum production cannot be obtained. It is, therefore, employed only in case of necessity, or where machine work is relatively unimportant, or for machines doing only a single restricted class of work.

The alternating current motor used for this drive is of the squirrel cage type, which is the simplest motor made. It consists only of a frame with a set of coils, a very rugged rotating part, and two bearings, and it has no moving electrical contacts and therefore does not spark. It is, however, a strictly one-speed machine.

Squirrel cage motors in sizes of 5 horsepower and less are usually started by being directly connected to the line. For larger motors, auto-starters, which bring the motors gradually up to speeds in two steps, are used.

PUNCHES AND SHEARS

The chief features of this important class of shipbuilding machinery are: (1) the speed is constant, and (2) the load varies almost instantly from zero to maximum, so that a flywheel is needed to assist in the operation of the machine.

Alternating current motors are preferred for the drive of these machines, but direct current motors are also entirely satisfactory. The motor can be either geared or belted to the machine, but recent practice favors gearing because it is positive and does not slip when the load comes on.

Direct Current Motors.—The direct current motor used for this service is the compound wound type. This differs from the shunt wound machine in the construction of the field coils, but the essential difference lies in the fact that its speed varies more widely with the load than does that of the shunt wound motor.

This characteristic of the compound wound motor is of importance in driving punches and shears, because when the load comes on, the motor tends to slow down, thus permitting the flywheel to carry the machine over the peak. This, of course, reduces the speed of the flywheel somewhat, but as soon as the load goes off, the motor speeds up again and restores energy to the flywheel for use at the next stroke. The result of this process is to smooth out the power demand of the machine and eliminate the high peaks that would occur with the use of a strictly constant speed motor.

These motors require only a starter of either the manually operated or the

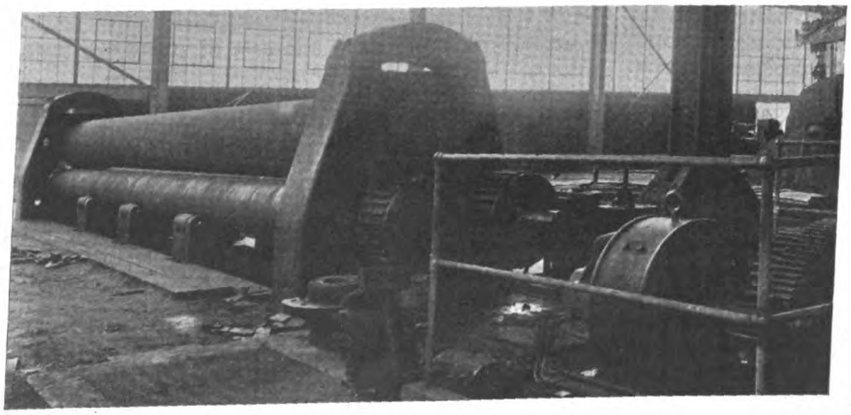

Fig. 10.—100-Horsepower Compound Wound Direct Current Motor Driving Heavy Duty Bending Roll, New York Shipbuilding Corporation, Camden, N. J.

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push button automatic type, whichever may be preferred.

Alternating Current Motors.—Though many standard squirrel cage alternating current motors are in use for driving punches and shears, the preferred type of motor for this service is that known as the "high slip" or "high torque" squirrel cage motor. The construction of this motor is the same as that of the standard type, except that the electrical resistance of the rotor circuit is increased by the use of a special alloy in place of copper. This increased resistance causes the motor to slow down under load and thus produces a speed characteristic similar to that of the compound wound direct current motor described above and permits the flywheel to carry the peak loads in a similar way. An auto-starter is the only control device required.

The squirrel cage motor, of either the standard or the high slip type, has, however, a limitation that sometimes prevents its use in large sizes: it draws a very large amount of current from the line in starting. Where a shipyard has its own power plant and the capacity of the generating and transmission system is sufficiently large, this momentary excess demand for current is of no importance, but central stations often prohibit the use of squirrel cage motors larger than a specified size (from 5 to 25 horsepower, depending on conditions).

Under such conditions the continuous-duty wound rotor motor is employed. This motor is similar to the squirrel cage, except that the rotor is so arranged that resistance varied, by means of a drum controller, can be inserted in the rotor circuit. By starting the motor with all the resistance in series and bringing it gradually up to speed by cutting the resistance out step by step (just as with a direct current motor), the rush of current during the starting period is avoided. When operating at full speed, this motor has the same characteristics as a high-slip motor.

Bending and Straightening Rolls

Either direct current or alternating current motors are satisfactory for driving bending and straightening rolls.

Direct Current Motors.—A special type of direct current motor, called the "bending roll" motor, is used for this service. This motor is very heavily compound wound, so that its full load speed is about one-half its no-load speed. Consequently, when the plate enters the rolls the motor speed immediately falls off, thus protecting the motor and the rolls from shock; but when the rolls grip, the load lightens and the speed increases. These motors are supplied with either drum type or automatic starters, arranged for reversing the motor.

Alternating Current Motors.—The alternating current motor used for operating bending and straightening rolls is the wound rotor, "intermittent duty" type, with a reversing drum type controller. The intermittent duty, wound rotor motor closely resembles the continuous duty motor described above, but it is specially designed to develop high power for short intervals and it is not suitable for continuous operation at full rated load.

Wood Working Machinery

Practically all of the machinery in the joiner's shop is of the constant speed type and can be driven by either squirrel cage, alternating current motors or shunt wound, direct current motors. The former are, however, by far the better because they do not spark and their simple construction makes them practically immune from troubles due to the presence of sawdust. Consequently, the squirrel cage motor is always used for driving wood working machinery wherever possible.

It is well to point out, however, that though a squirrel cage motor *can* operate half buried in sawdust, it is bad practice to allow it to do so. It should, of course, be kept clean and be blown out with compressed air at least once a week.

If direct current motors are used, they must in general be totally enclosed to prevent the entrance of sawdust, and the starters must be provided with covers, so that the sparks at the contacts cannot start fires.

Headstock Motors.—Though the turning lathe is generally driven by a constant speed motor, it is an exception to the general rule of wood working machinery, inasmuch as an adjustable speed, direct current motor forms its best drive.

A special form of direct current motor is supplied for this machine. This motor forms the headstock of the lathe, the shaft being threaded to take both a live center and a face plate, and it can be operated over a speed range of from 600 to 3,000 revolutions per minute by means of a controller mounted on a leg of the lathe. This arrangement eliminates belts, greatly simplifies the lathe, provides a wide range of speeds, and permits a considerable increase in production.

Air Compressors

The air compressor is a constant speed machine and can be driven by either a shunt wound, direct current motor or a squirrel cage (or wound rotor), alternating-current motor. Another type of motor—the synchronous—is, however, being favored for large compressors in alternating current plants.

The synchronous motor is quite different from either the squirrel cage or the wound rotor motor, being, in fact, an alternating current generator with certain modifications. Among its advantages are a rigidly constant speed and a high operating efficiency, but the main reason for its use in industrial plants is its ability to "correct the power factor" of the alternating current system.

A full discussion of power factor is not possible here, but, briefly, in a plant where there is a number of squirrel cage and wound rotor motors an adverse condition tends to arise in the power supply, known as "low" power factor. Low power factor causes certain operating troubles that interfere with the efficient operation of the plant, but it is readily corrected by operating a synchronous motor of proper capacity on the line.

A machine to be driven by a synchronous motor must start lightly loaded, run continuously at constant speed, and be of comparatively large size. The air compressor fulfills these requirements, so it is usually selected for synchronous motor drive in a shipyard, though large centrifugal pumps are also often driven in the same manner. The motor is generally of the high-voltage type and operated directly from the main power when central station power is used, thus saving the cost of step-down transformers.

As the synchronous motor requires expert attention, it is generally placed in the power plant. Small compressors located throughout the yard are driven by squirrel cage motors.

Dry Dock Pumps

For operating dry dock pumps, comparatively large amounts of power must ordinarily be transmitted considerable distances, so that alternating current is almost invariably used in this service. There are, it is true, cases where the power house is located close to the dock and the cables are so short that the use of direct current is practicable; but such cases are exceptional.

Floating Docks.—The pumps of floating docks may be driven in two ways:

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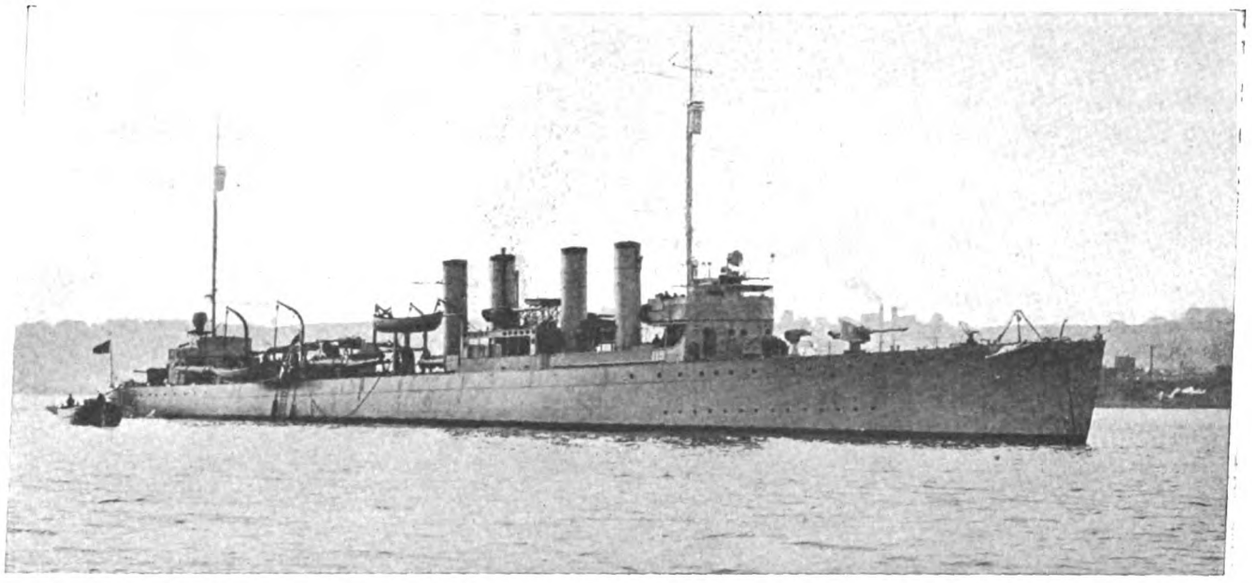

Fig. 1.—U. S. S. Destroyer *Clemson*: Displacement, 1,200 Tons; Horsepower, 28,000; Speed, 35 Knots

All of these organizations accepted the invitation with the exception of the American Railroad Association, which is unable to act at this time, but may do so later on. The Canadian Engineering Standards Association has also been invited to co-operate, but has so far not been able to do so actively. A number of conferences have been held, and on April 27 the committee formulated a complete preliminary report for transmission to the British Engineering Standards Association as a basis for discussion on common Anglo-American standards.

The representatives are as follows:

United States Navy:
Commander C. M. Simmers.
Lieut. Com. H. D. Rouzer.
Association of American Steel Manufacturers:
R. B. Woodworth (chairman).
G. H. Blakeley.
G. E. Thackray.
American Bureau of Shipping:
Captain C. A. McAllister.
David Arnott.
John Martin.
American Society of Civil Engineers:
J. H. Edwards.
J. B. French.
H. G. Balcom.
Society of Naval Architects and Marine Engineers:
Fred T. Llewellyn.
E. H. Rigg.
J. W. Stewart.
Railway Car Manufacturers' Association:
A. E. Ostrander.

The representatives of the various organizations referred to above are known as the "Sectional Committee on Steel Shapes" of the joint sponsor bodies—the American Society of Civil Engineers, the Association of American Steel Manufacturers, and the Society of Naval Architects and Marine Engineers—and they are very anxious to get a full and free discussion of the whole subject by anyone interested. Criticisms or suggestions will be cordially welcomed by the committee. Communications should be addressed to Dr. P. G. Agnew, secretary, American Engineering Standards Committee, 29 West 39th street, New York City.

Geared Turbines for Torpedo Boat Destroyers

THE U. S. S. *Clemson,* which recently went into commission, represents our latest type of torpedo boat destroyer. This vessel has a displacement of 1,200 tons, a speed of 35 knots, and an engine power of 28,000 horsepower. This engine power, it is interesting to note, is the same as that for the 30,000-ton, 21-knot, electrically-operated battleship *Tennessee,* and, since the propelling machinery of the destroyer is crowded into one-tenth the space available on the battleship and is handled by less than one-fifth the men, it is evident that this machinery must possess special features of compactness and simplicity.

The arrangement of the destroyer's engine room is shown in the diagram Fig. 2. Each of the two propellers

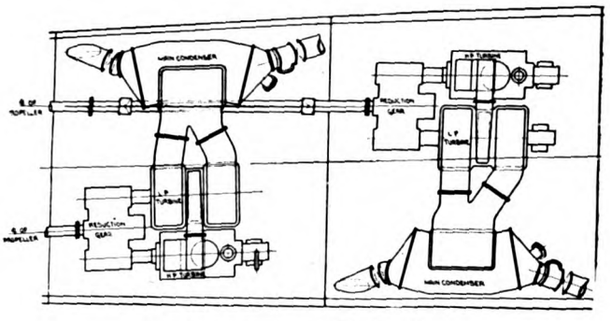

Fig. 2.—Diagram of Engine Room

is driven by a Westinghouse turbine, consisting of a high-pressure and a low-pressure element, geared to the propeller by means of a floating-frame type of gear. Normally both elements drive their propeller together, but if either is out of commission the other can be used alone, although the propeller speed will, of course, be reduced.

The total weight of these two turbines with their gears is 76 tons, and the deck space occupied, including auxiliaries, is 1,550 square feet. These figures can be compared with 615 tons and 12,000 square feet, which are the weight of and the space occupied by the *Tennessee's* machinery. The difference in favor of the destroyer's

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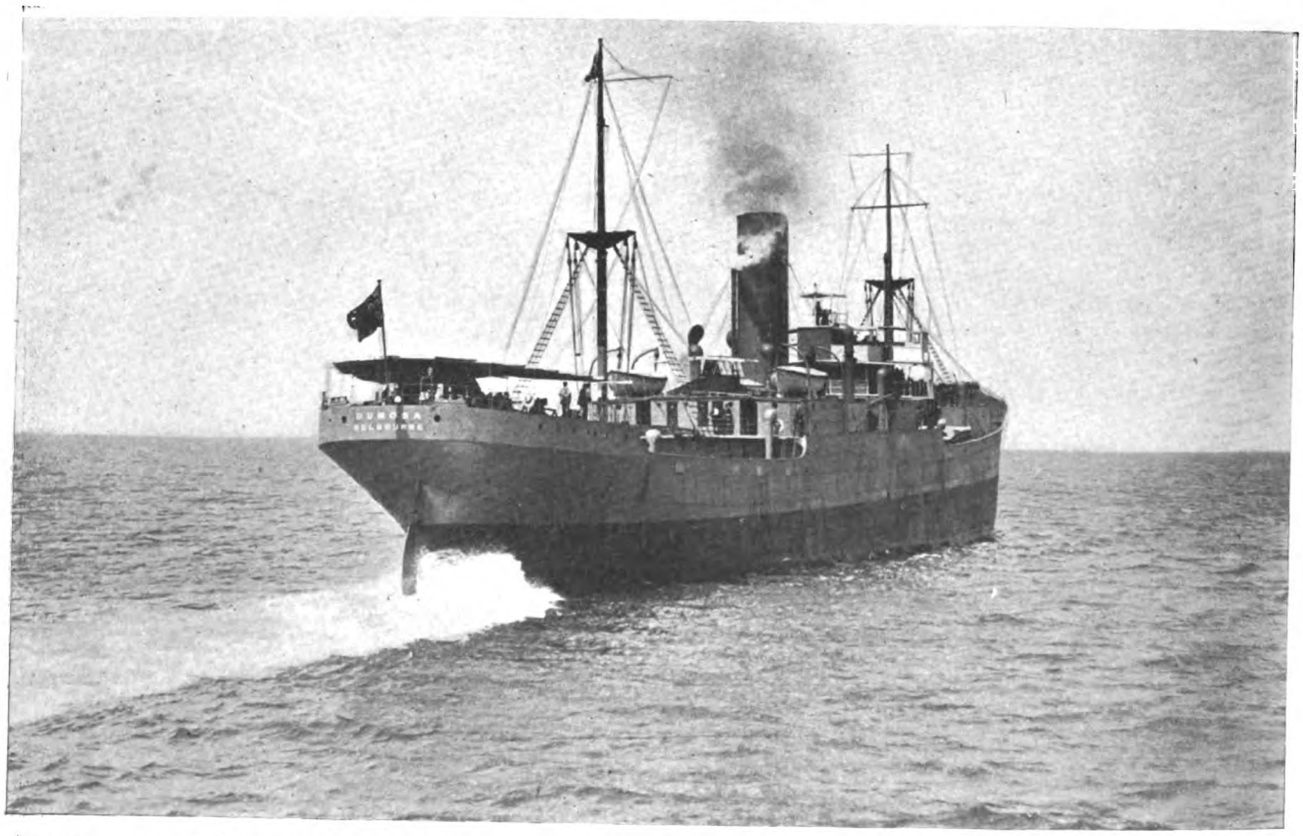

S. S. *Dumosa* on Her Trial Trip. The Vessel Was Built at the Commonwealth Government Dockyard, Williamstown, Australia, and Has a Deadweight Capacity of 5,600 Tons on a Draft of 21 Feet 9 Inches

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This arrangement is quite different from that used on the older 750-ton, geared-turbine driven destroyers *Mayrant* and *Henley*. In these latter vessels the high and low pressure elements of the main turbine are in the same casing, while the cruising turbine is separate, being geared to the main turbine. When the main turbine of this latter type is in use, the cruising turbine is disconnected by means of a clutch, and when the cruising turbine is in use it drives the propeller through the main turbine, which turns idly. This method permits better steam economy, especially at cruising speeds, than that used in the *Clemson* type, but space limitation prevents its use on the later destroyers.

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The captain and officers are berthed amidships, the engineers on the bridge alongside the engine casings, and the crew in the poop. All accommodations are ample in size, with separate messrooms for the firemen and sailors, as well as baths and washrooms.

Propelling Machinery

The machinery consists of triple-expansion engines with cylinders 25, 41 and 68 inches diameter by 45 inches stroke, and three Babcock and Wilcox watertube boilers, designed for a working pressure of 180 pounds per square inch. The machinery was constructed by Messrs. Thompson & Company, Castlemaine, Victoria. With the exception of a portion of the steel plates, special parts for the boilers and a few items of equipment, the material and auxiliaries were manufactured in Australia.

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Observations Here and There

BY "OLD SCOTCH"

SEVERAL years ago, many readers may remember, I contributed a series of articles on economy in ship operation with particular reference to the engine room, where success or failure is most likely to be started in running ships. Along came the war and economy in everything was thrown to the winds and I had to duck under to avoid the orgy of spending which was started then and still continues. The ominous clouds of extravagance are beginning to break away, so I am going to venture from my retreat, and by permission of the new management will periodically break out with a few remarks on the passing marine show, which from now on promises to provide many interesting phases for such remarks.

Whereas in former papers reference was made to possible savings in fuel, oil, stores, etc., such items were mere economies at the spigot, and the bunghole was unprotected. Now, nationally, we have had a rude awakening and our first efforts must be to chop down the big extravagances. Why, for example, have we been contented to spend from $300,000,000 (£63,000,000) to $400,000,000 (£82,000,000) per annum for many years past to foreign shipowners to carry our exports and imports for us? Our low ebb was reached in 1910, when we supinely permitted only 8.7 percent of our goods to be carried to and fro over the oceans in American ships. Last year we had remedied this state of affairs to the extent of carrying 27.8 percent of goods in American bottoms. Of course, in the very nature of trade we cannot expect to carry all of our goods back and forth, but we should reasonably aspire to carrying 60 percent of our water-borne commerce. All the nations with which we trade do not have their own merchant marines, so 10 percent over the half of our foreign commerce is but a reasonable expectation for us to assume. The aftermath of the war has left us with the ships in which to carry that proportion of our foreign commerce; all we have to do is to so encourage our shipyards, shipowners and ship operators to keep this fleet up and operating as economically as possible to insure our getting the 60 percent of our ocean-carrying trade to which we are rightfully entitled.

For many years I have watched and prayed that our congressional representatives could see the light and not be misguided by foreign propaganda into enacting legislation to hinder our shipping efforts, instead of helping it. If my prayers haven't been answered, somebody has performed a better praying job than I am capable of, for unless all signs fail the pending shipping bill in Congress will come pretty near to satisfying our most ardent desires so far as the restitution and continuance of our merchant marine is concerned. It's a real American bill from stem to stern and backed by the right spirit. Just listen to this, all ye old-timers who have for many years all but given up hopes for the American merchant marine; this is what the commerce committee of the United States Senate said unanimously in reporting favorably on the Jones bill:

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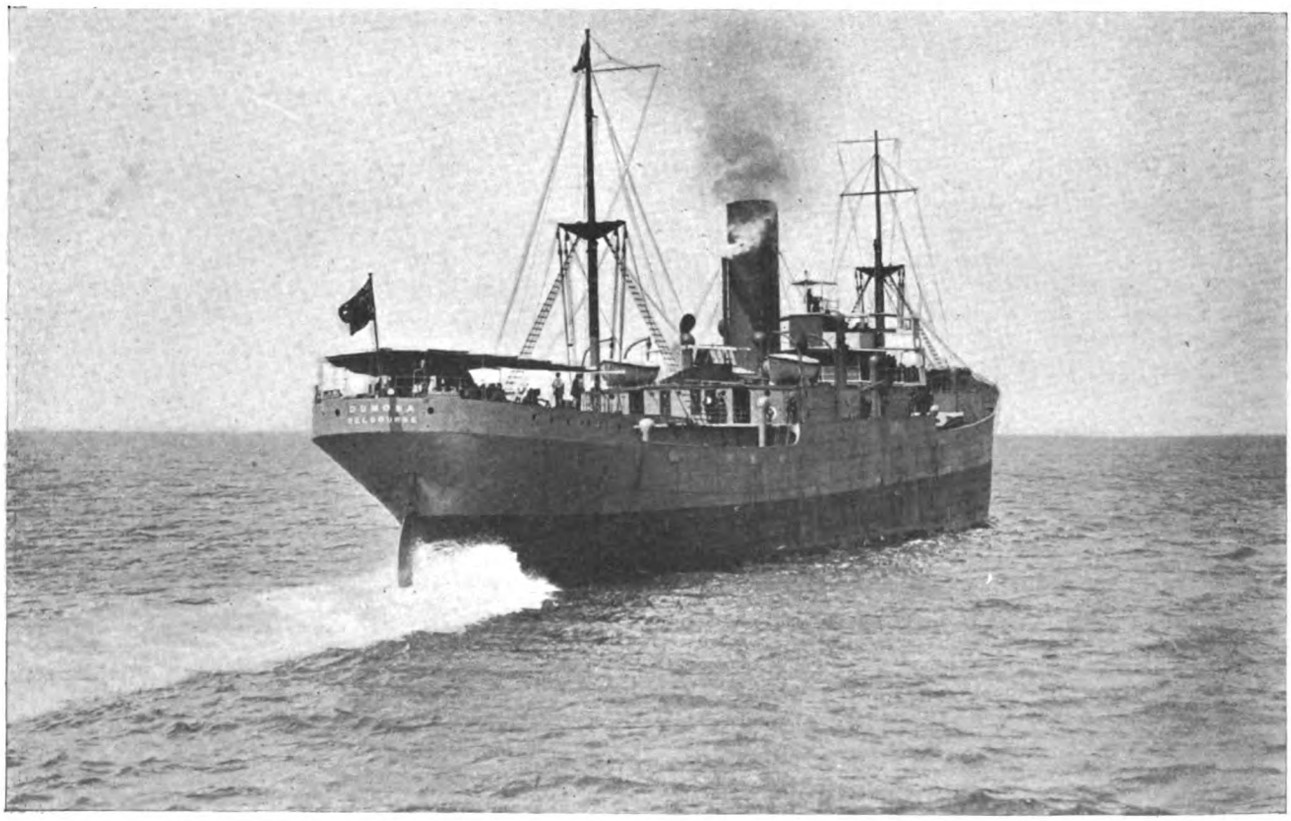

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wood with practically no frames. May the best boat win, say all fair-minded persons, but we on this side naturally place our hopes on the Yankee craft. If we are going to win with our merchant marine, we must put our best foot foremost and pay attention to every detail, as we have always done with our yachts.

Have you noticed the nation-wide publicity propaganda regarding American ships and shipping now being put out by the Shipbuilders' Association? They are spreading broadcast, in very attractively-worded advertisements in the leading papers, the salient facts both historical and contemporaneous in connection with shipping generally. It is a liberal education in maritime matters to read these pronouncements. This is splendid work and shows that the American shipbuilders are alive and on the job. Their contention is that the best policy to pursue for the sale of Government-owned ships is to make the operation of ships under the American flag profitable to shipping men and to investors in ship securities.

In that they are entirely right, and I can foresee very beneficial results to our merchant marine accruing from this campaign of publicity. In this matter shipbuilders have taken their cue from the American railroad executives, who before and during the discussions of the recently adopted constructive railroad legislation in Congress used the power of the press in setting forth straightout facts concerning the problems which confronted them. By this means the voters at home became informed as to the reasons which guided their representatives in Congress to vote for that particular piece of constructive regulation. By the combined efforts of railroad managers and shipbuilders the American public will become educated in the vital problems of transportation both on land and sea, which are so essential to our well-being and comfort.

While this legislation is pending in Congress there is a notable slackening up of marine activities both in shipbuilding and ship operating. All eyes are turned towards Washington. If the present Senate bill is enacted into law without any vital changes, as now seems apparent, the American merchant marine will take a new and strong stand for the fierce competition which awaits it on the reassumption of normal conditions in sea trade which seem to be fast approaching. Already the swollen freight rates, whereby anybody could operate anything that floated with reasonable chances of success, are shrinking. To give an idea of the direct relation which ocean freight charges bear to our everyday existence, we have only to imagine the problems of living on the other side of the Atlantic. Owing to the great shortage of coal, due to the ravages of war, thousands of tons must be shipped from this side. To an initial cost of six to seven dollars (1/5/0 to 1/9/2) per ton here at the port of departure must be added a minimum freight rate by sea of twenty dollars (4/3/4) per ton to a seaport in Continental Europe. Imagine the problem confronting you, if you lived at an interior city in France or Italy, and had to lay in your winter's supply of that most necessary element of future comfort. If the local coal dealer be a profiteer, as most likely he is, your bank account would be set back at the rate of about forty or fifty dollars (8/6/8 or 10/8/4) for every ton of coal you laid in. Thank God every day that you are living in America, and pray for a good merchant marine.

Special Committee of Business Men Recommends Terms for Sale of Shipping Board Vessels

EUGENE MEYER, JR., managing director of the War Finance Corporation, chairman of the special committee appointed by Admiral Benson, chairman of the Shipping Board, on April 15 to make recommendations as to prices, terms and conditions for the sale of ships now owned or being constructed by the United States Shipping Board, has submitted the following report:

"Your committee understands that a decision has been reached to sell the ships now owned and under construction by the United States Shipping Board, and, furthermore, that the resolution as passed at the meeting of the general committee stated that the ships should 'be sold at such prices and on such terms as will encourage the investment by shipping interests to the end that the merchant marine of the United States may be firmly established.'

"Your committee understands that it was appointed for the purpose of making informal suggestions of general terms upon which it would seem appropriate to dispose of the ships.

"Your committee understands that its suggestions concern only the sale of ships that the Shipping Board considers desirable to be retained for the permanent American merchant marine; and further that it is not expected to deal with special phases of the shipping problem such as are involved in the question of maintaining special trade routes which may be desirable in the national interest.

PRICES

"With regard to prices, the committee recommends that (1) as the ships were built as a war measure and in a period of abnormal and excessive cost, due to war conditions and to the fact that the industry had to be built up as a substantially new industry in this country, the abnormal cost should be absorbed as war waste, and that the prices should be fixed upon the basis of present prices for reproduction, considering both foreign and domestic production costs; and that (2) the prices should be determined in a manner to assure stability, either by fixing prices for ships of given types and tonnages which could be maintained over a period sufficiently long to give buyers the assurance that after they have contracted for purchases of ships they will not be placed at a disadvantage by subsequent reduction in prices, or by fixing prices with definite protection to buyers over a definite period, such protection to consist of an arrangement under careful safeguards for price readjustment should it subsequently prove necessary or desirable for the Shipping Board to reduce prices.

TERMS OF SALE

"With regard to terms, your committee suggests as follows: Ten percent cash payable on delivery of the ship, with payments at the rate of five percent semi-annually for three years, making a total of forty percent to be paid in by the end of the third year; the balance, or sixty percent, to be payable in twelve yearly installments of five percent each. In connection with these terms, which have been arrived at with a view to making it possible under present financial conditions for buyers to arrange the necessary financing, your committee recommends that purchasers be required to render carefully supervised and audited accounts of operations and earnings on these ships in such a way as seems well to your Board. Out of the earnings, after providing for the interest, taxes and current installment payment on account of principal, an adequate return on the actual capital invested should be allowed the purchasers; after such adequate return on the investment at a rate to be fixed by your Board, surplus net earnings should be applied to additional payments of the installments of principal. The committee would consider it preferable to have the anticipation of such installments, if any, applicable to the last installments due, but feels that a certain amount of discretion should be exercised upon this point by your Board, and it may be advisable to have this clause contain some elements of elasticity so that anticipated installments may be in whole or in part applied to installments falling due in a period of possible business depression.

"The committee recommends that interest be charged at the rate of six percent per annum, and the Shipping Board should

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have full protection by insurance on all marine risks and fire. Title should remain in the United States Government, with proper protection to it by purchaser's bond or otherwise, until a proportion of the total principal amount of the purchase price, to be fixed in the discretion of your Board, shall have been paid over, after which it would appear proper to pass the title and take a first lien with proper safeguards on the vessel as security in the legal form suitable for such business.

"The committee suggests that a discount of five percent for cash payment in full on the delivery of the ship be allowed. In cases where cash is not paid in full on delivery of the ship, the committee suggests the buyer be given the right of a cash discount of two and one-half percent in case of full payment for the ship at any time within five years from the date of delivery. It appears to the committee that in case of default of principal or interest, the Government should have the right immediately to repossess any ships sold under a contract, and the Government should have the right to resell such ships as may be taken over at public or private sale, the net surplus, if any, after deduction of all indebtedness, to be paid out to the obligor.

"Your committee suggests that in view of the small cash payments required under the above recommendations, the Board use careful discrimination as to the responsibility of purchasers, whether the purchasers be large or small. The committee ventures to emphasize the point of 'responsibity' of the purchasers because the committee feels that in a considerable degree methods which restrict sales to responsible parties will give greater confidence to the class of buyers who desire to go into the shipping business in a substantial and permanent manner. In using the word 'responsibility,' the committee has in mind not only the character and resources of the parties concerned, but also their ability to handle the business competently and efficiently. Smaller concerns may be as responsible for moderate commitments as larger concerns would be for larger commitments.

"Your committee suggests that parties making purchase contracts should be protected against unequal competition from operating contracts upon unduly easy terms in connection with ships still unsold.

"In conclusion, your committee suggests that it would seem proper, in view of the fact that the ships constitute a capital asset of the United States Government, that the funds received on account of repayment of principal should be applied to the redemption, at the market prices, of Liberty Loan Bonds or Victory Loan Notes. Should your Board have occasion to recommend legislation to Congress, your committee suggests that you include a recommendation to this effect."

Meters and Inches

BY PROFESSOR C. H. PEABODY*

A MAN has five fingers on his hand; hence the decimal system, which in ways is inconvenient. If a man had four fingers, we should have the binary system; if he had six fingers, we should have the duodecimal system. Each of the two systems last mentioned is so convenient that they are persistently used and will continue to be. It is probable that either, once established with its proper notation and means of computation such as multiplication table and logarithms, could dominate the mathematical world. So much for the sacrosanct decimal system. But the decimal system now established will always remain dominant, though enthusiasts may dream of reformation.

The apotheosis of the decimal system is found in the metric system, which truly has its inconsistencies and inconveniences; but it serves where it is in use and will continue, probably squeezing out the remnants of older systems, though the process is less rapid and perfect than its protagonists represent. It is most amusing to compare the maps issued by the propaganda for the metric system and the maps of the defenders of the dominant industrial system of Britain and America. The aberration of statistics seems to have run wild in these maps.

Without going into statistics, it may be claimed that the English inch is now the dominant unit of length in the industrial world; roughly, its dominance can be represented by the fraction three-fourth. This does not mean that it will become universal; we are probably doomed to have two systems of weights and measures and to get along as best we may under that condition. But most of the world knows one system or the other; and using habitually one system and having no knowledge of the other has little occasion to worry. In fact, nobody appears to worry except certain reformers and those whom they worry by threatening legal enactments.

Let it now be boldly said that the system of weights and measures of the British Empire and the United States cannot be changed. Congress has great power and Parliament is not even limited by a written constitution, but singly or both together they cannot change the practical use of the systems of weights and measures of their countries. Both deliberative bodies have in them men of information and common sense, and it most unlikely that either will attempt legislation looking toward the substitution of any other system in place of the one now in use. But there is just enough chance that something may be slipped over to worry the engineering world and make it necessary to meet propaganda with propaganda because the mass of people do not know that it can be done. In fact, a considerable number of scientists and enthusiasts think it can be done.

There are three arguments in favor of a change: (1) that the metric system is scientific, (2) that it is more convenient, and (3) the advantage of uniformity. Taking the last first, we can but admit it; it would be a good thing if we could get it. There is no evidence that meters are more convenient than inches; perhaps the latter have the advantage. Scientists use the metric system and for their purpose it is convenient, but its advantages are too much extolled. Probably, if scientists were trained on the English units, they would get along very comfortably.

At one time the United States army had a practical cap, a sensible cap; such as a civilian would wear. It came between the old civil war style and the English style now in use. The only fault found with it was that it was not military. A hard-headed American officer gave the real reply to this criticism. He said that a military cap was a cap worn by military men. Now the writer has had occasion to use both systems of measure and to transform from one to the other, and after a study of the original pretensions of the metric system and its real status he is of the opinion that it is scientific because scientists use it.

Three centuries ago tramways were laid in England for hauling coal. The wagons then in use had a gage of four feet eight inches and a half. So in 1814 Stevenson's locomotive had the same gage and now the standard gage of England and America is four feet eight inches and a half. Let the proponents of the metric system undertake to increase this gage by the amount of two inches and a half, to 1.5 meters, and then let them pause before attacking the standard airbrake fittings.

There are three English institutions that need reformation. Naming them in the order of difficulty (if such an expression is proper concerning what cannot be done), they are the English language, the English weights and measures, and the English money. An English commission has just reported adversely concerning a proposed change of money to a decimal system.

* Head of the Department of Naval Architecture and Marine Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

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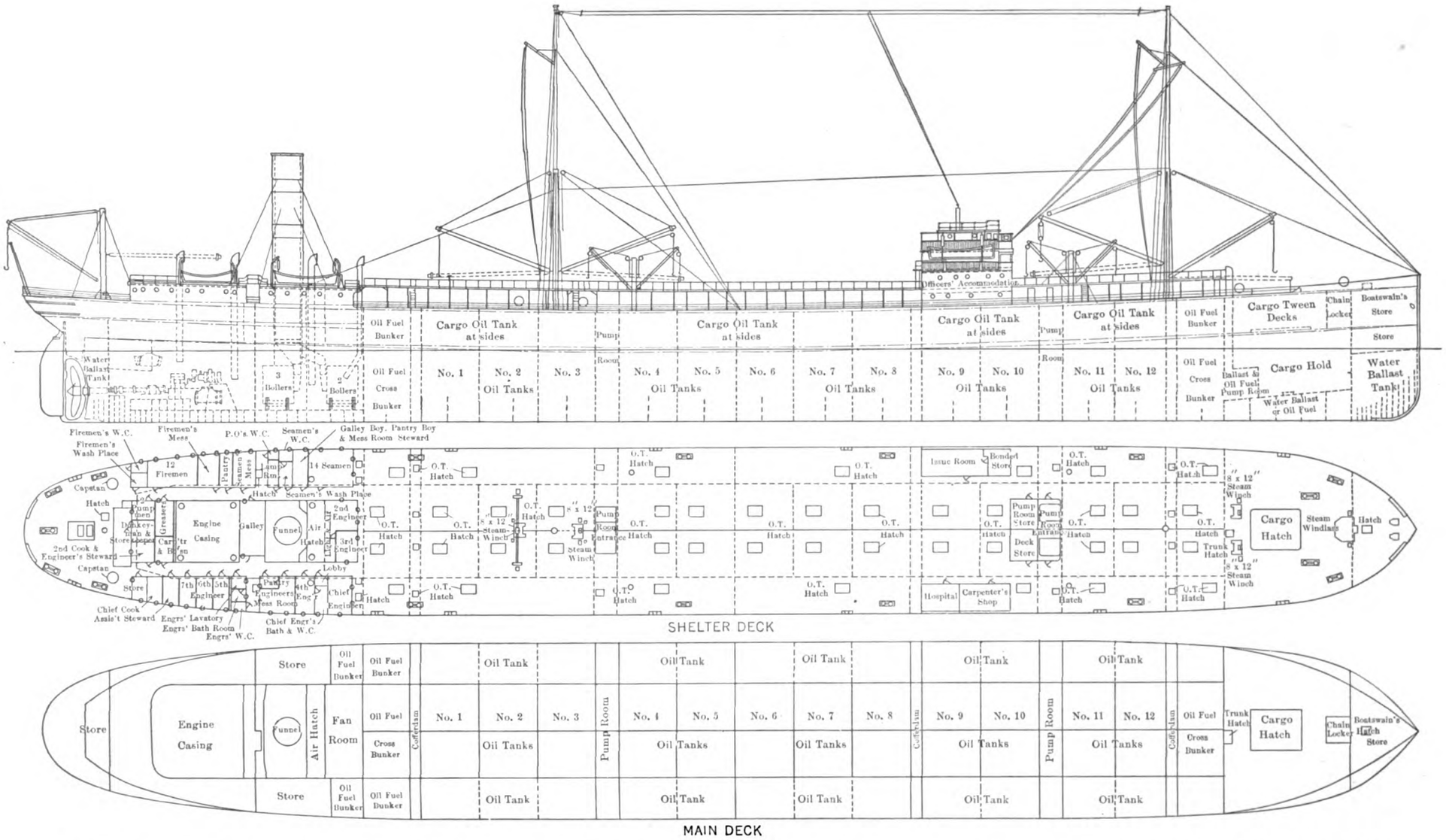

Fig. 1.—Profile and Deck Plans of 18,000-Ton Oil Tanker *San Fernando*: Length Overall, 547 Feet; Length Between Perpendiculars, 530 Feet; Breadth, Molded, 69 Feet; Depth, Molded, 42 Feet 3 Inches; Deadweight Tonnage at Maximum Draft of 30 Feet 8¼ Inches, 18,550 Tons

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Oil Tank Steamer San Fernando

Largest of the New Fleet of 18,000-Ton Steamers Building for the Eagle Oil Transport Company, Limited

BY MAJOR F. C. COLEMAN

SIR W. G. ARMSTRONG, WHITWORTH AND COMPANY, LIMITED, has just completed at the Walker shipyard, Newcastle-upon-Tyne, the *San Fernando*, which is the largest oil tank steamer afloat, and one which illustrates the best present-day practice in the construction of this type of vessel. The *San Fernando* is one of the latest class of oil tank steamers constructed for the Eagle Oil Transport Company, Limited, and is a development of the 15,000-ton oil tank steamers which were constructed some four or five years ago for this firm by various shipyards on the northeast coast, three of these vessels being built at the Walker shipyard. The steady increase in size of the oil tankers in this company's fleet is very marked, previous vessels built for them being 9,400 and 15,000 tons deadweight.

With regard to the propelling machinery the same progressive spirit is shown by this firm, as the *San Fernando* and sister ships are engined by double-reduction geared turbines of the Brown-Curtis type, superheated steam being supplied to these engines from five cylindrical boilers fitted with oil fuel burning installations. This system is the latest development in marine steam engineering, and is undoubtedly the most economical form of steam propulsion extant.

The *San Fernando* is of the single deck and shelter deck type, and, like all the other large oil tank steamers owned by the Eagle Transport Company, Limited, and similar companies, is built on the Isherwood system of framing, which gives certain advantages for vessels of this type.

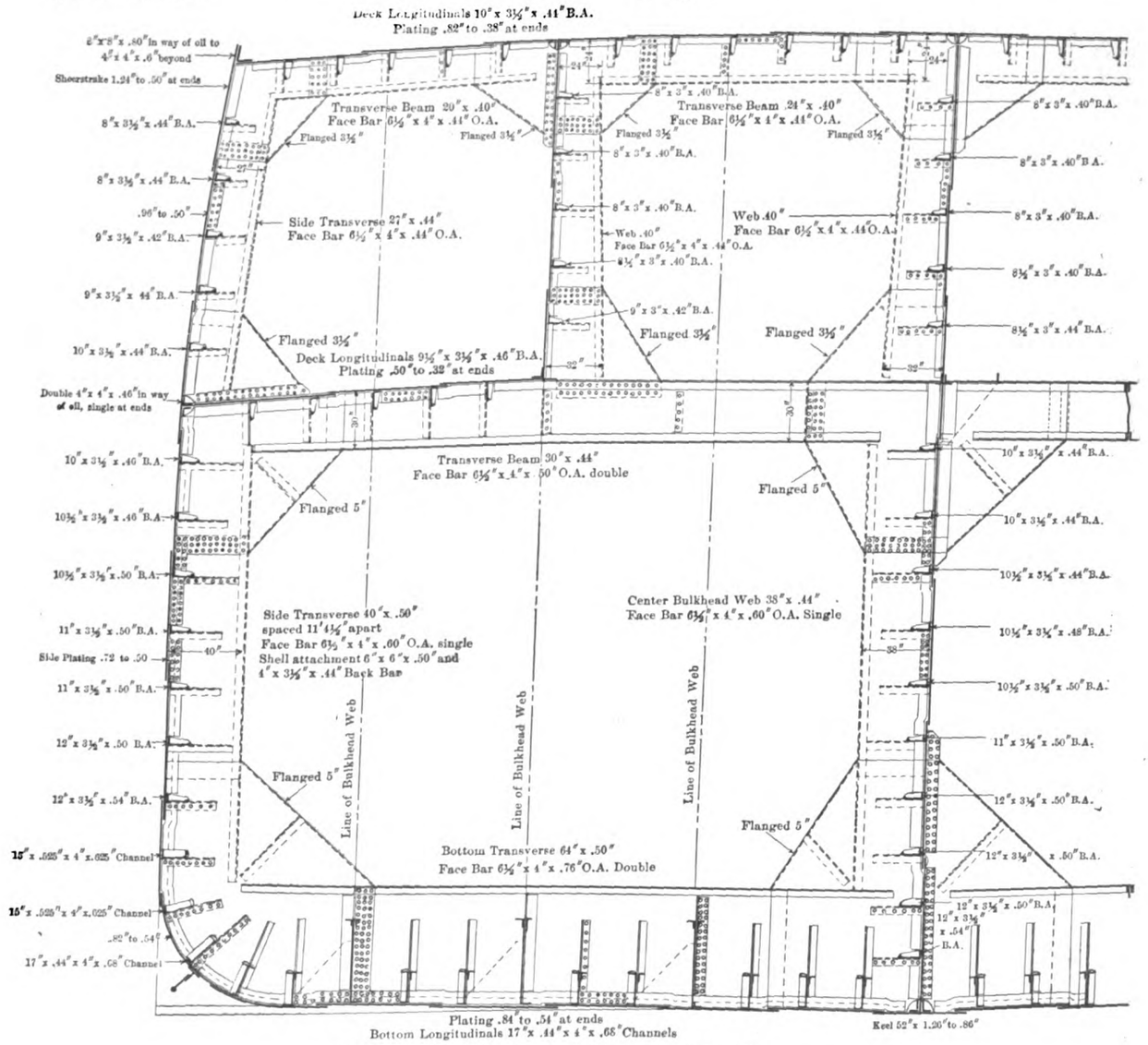
Deck Longitudinals 10" x 3½" x .41" B.A.
Plating .82" to .38" at ends
Transverse Beam 20" x .40"
Face Bar 6½" x 4" x .44" O.A.
Transverse Beam 24" x .40"
Face Bar 6½" x 4" x .44" O.A.
Side Transverse 27" x .44"
Face Bar 6½" x 4" x .44" O.A.
Web .40"
Face Bar 6½" x 4" x .44" O.A.
Deck Longitudinals 9½" x 3½" x .46" B.A.
Plating .50" to .32" at ends
Transverse Beam 30" x .44"
Face Bar 6½" x 4" x .50" O.A. double
Side Transverse 40" x .50"
spaced 11' 4½" apart
Face Bar 6½" x 4" x .60" O.A. single
Shell attachment 6" x 6" x .50" and
4" x 3½" x .44" Back Bar
Center Bulkhead Web 38" x .44"
Face Bar 6½" x 4" x .60" O.A. Single
Line of Bulkhead Web
Bottom Transverse 64" x .50"
Face Bar 6½" x 4" x .76" O.A. Double
Plating .84" to .54" at ends
Bottom Longitudinals 17" x .44" x 4" x .68" Channels
Keel 52" x 1.20" to .86"

Fig. 2.—Midship Section, Showing Principal Scantlings

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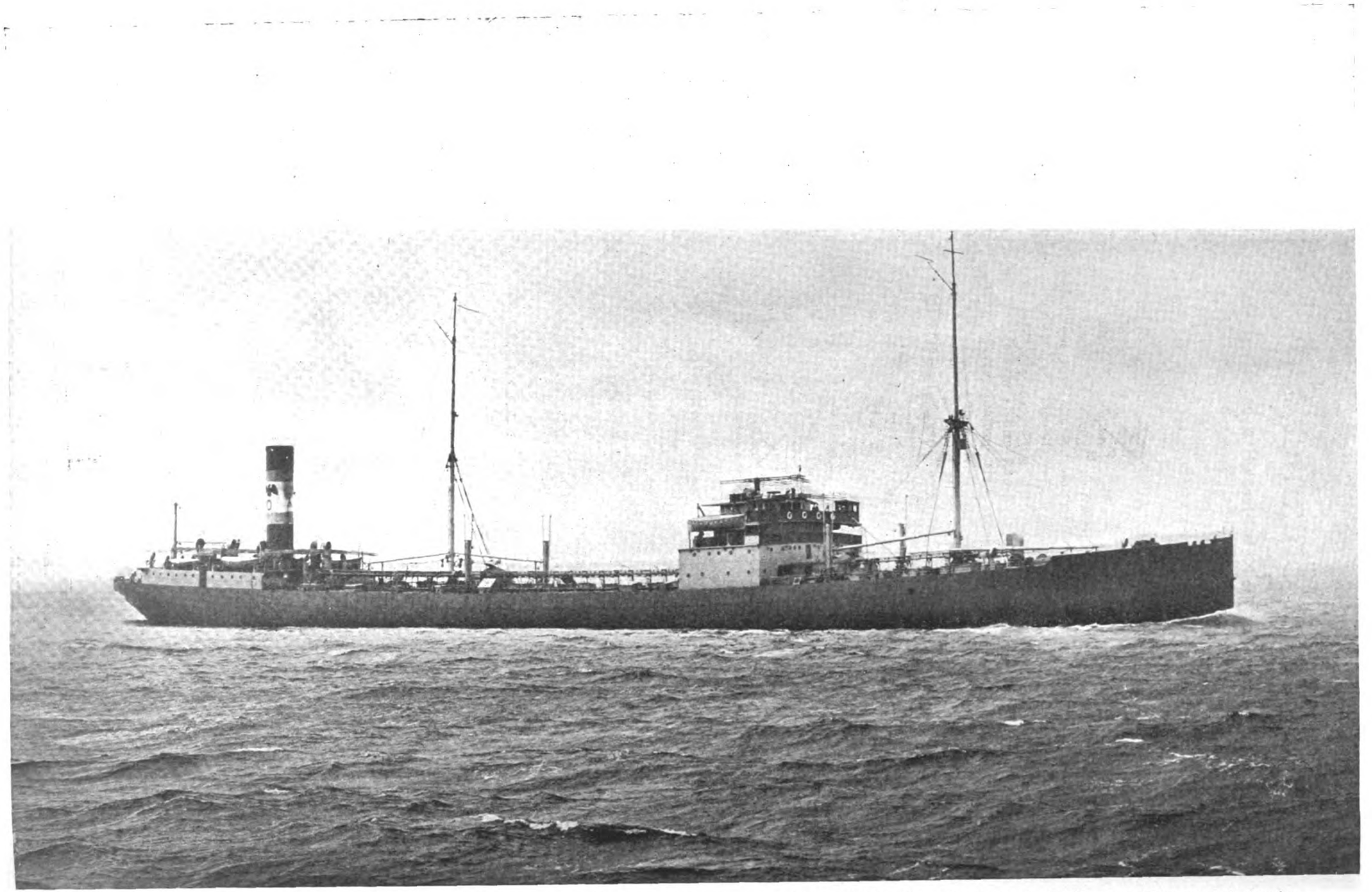

Fig. 3.—18,000-Ton Oil Tank Steamer *San Fernando* Built by Armstrong, Whitworth and Company, Ltd., Newcastle-Upon-Tyne, for the Eagle Oil Transport Company, Ltd., London

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The various scantlings are, in many cases, increased over those required by Lloyds Registry, the thickness of the sheer strake and shelter deck plating, for example, being considerably in excess of that required by this society. This increase was made in order to give additional longitudinal stiffness.

The principal dimensions of the *San Fernando* are:

	Feet	Inches
Length overall	547	0
Length between perpendiculars	530	0
Breadth molded	69	0
Depth molded	42	3
Height between shelter and main decks	15	0
Extreme draft of water	30	8¼

Deadweight at above draft, 18,550 tons

It will be seen from the drawings that the main cargo space of the vessel is divided into fourteen oil tanks, each about 22 feet 6 inches long, these tanks being further subdivided by a central longitudinal oiltight bulkhead which continues through the various pumping rooms and cofferdams. The foremost and aftermost of these tanks are fitted up as oil fuel bunkers, the deep double bottom in the cargo hold forward being also utilized for this purpose.

In the earlier tank steamers—which were of small dimensions, and which, as a rule, only carried one class of oil of light specific gravity—it was the custom to fit only one pump room, usually at the after end of the cargo oil tanks. Owing, however, to the greatly increased size of these vessels and the different varieties of oil, it has since been found essential to fit two pump rooms, the position of them being chiefly determined by the necessity of fitting the minimum lengths of suction pipes.

As the transverse bulkheads forming these pump rooms extend to the shelter deck, it will be seen that these compartments form additional cofferdams. The oil fuel bunkers are divided from the oil cargo tanks by cofferdams, and there is an additional cofferdam fitted between tanks Nos. 8 and 9.

By this arrangement the cargo tanks are divided into four self-contained groups, which, as already mentioned, are further subdivided by the central longitudinal bulkhead, thus enabling a variety of oils of different qualities and specific gravities to be carried without coming into contact with each other.

When the entire cargo which the vessel carries is oil of a light specific gravity, such as gasoline (petrol) or benzine, additional cargo space for obtaining the maximum deadweight is provided in the wing side tanks, which can be used either for carrying light cargoes or additional oil, in order to bring the vessel down to her normal draft.

Oil Pumping Equipment

The oil pumping installation is one of the most complete ever fitted in an oil tank steamer. There are four oil pumps, two in each pump room. They are of the Worthington duplex type, 12 inches and 22 inches by 11 inches by 18 inches, each capable of discharging 300 tons of oil per hour against a pressure of 200 pounds per square inch.

Two main lines of 10-inch oil pipes are fitted, one on each side of the longitudinal bulkhead. At each tank are fitted 8-inch suctions, together with an 8-inch crossover suction into the adjacent tank on the port or starboard side. These valves are all actuated by wrought iron rods, which are led up to and worked through stuffing boxes on the shelter deck; thus, in the event of one pipe line breaking down, the other main line can discharge oil from both port and starboard tanks simultaneously. There are, in all, 56 suction valves on the main cargo pipe lines. When all four pumps are working the entire oil cargo can be pumped out from the tanks in approximately 18 to 20 hours, while if only one main line of pipe is in use the time taken is about 36 to 40 hours. All the pumps are interchangeable, so that any pump in either pump room can be utilized for pumping through either of the main pipe lines.

Crossover pipes are also fitted between the two main oil pipe lines in Nos. 1 and 12 holds, which are controlled by master valves operated from the shelter deck. By this arrangement, therefore, oil can be transferred from any one tank to another. As already mentioned, the suction valves are actuated from the shelter deck only, but the transferring valves on the main pipe lines are operated from either pump room and are under the control only of the pump room engineers.

Ballast Pump Room Fitted Forward

A ballast pump room is fitted forward, and there is a complete installation of piping for dealing with oil fuel or water ballast in the deep tank and fore peak and forward oil fuel cross bunker.

In the *San Fernando* an indicator and name plate are fitted at each stuffing box on the shelter deck, which indicates when the valve is open or closed. It is therefore an easy matter for the engineer when loading or discharging oil from any one tank to another, or overboard, to open the particular valves he requires for this work before opening his transferring valves in the pump room.

The cargo oil can be discharged either through 8-inch discharge pipes on deck into barges, or alternatively through 8-inch discharge pipes over the stern. The crossover discharge pipes are fitted on the shelter deck at both pump rooms, there being a total of six on each side of the vessel, exclusive of the stern discharges. The advantage of this large number of discharging pipes is that at least four different kinds of oil can be discharged simultaneously through the various pipes without coming into contact with each other.

As very heavy oils are now being carried as cargo, it has been found necessary to fit cargo-heating pipes in order to facilitate the pumping out of this oil, as in some cases it is necessary to heat heavy oil to at least 100 degrees in order to obtain a satisfactory flow through the pipes. Steam is passed through 2-inch coiled pipes, which are laid in the bottom of the cargo tanks. The pipes are of wrought iron ¼-inch thick, with hydraulic joints, and are water tested to 300 pounds per square inch. Steam is passed to these pipes direct from the boiler, the pressure being reduced to 120 pounds by means of a reducing valve. The exhaust steam, after passing through these coils, is led back through a special exhaust pipe on deck to an exhaust tank in the engine room.

Vapor pipes are fitted to the main cargo tanks exhausting into a 5-inch main pipe, which is led 30 feet up each mast. The wing tanks are also fitted with short vapor pipes.

A fore and aft gangway is fitted from the ballast pump room forward to the poop deck aft, on the underside of which is hung on wrought iron hangers all deck steam pipes, wash-deck pipes, vapor, man-exhaust pipe, cargo steam heating pipes, cabin-heating steam and exhaust pipes, pipes for electric cables, telemotor pipes, dock and engine telegraph pipes.

Accommodations

The accommodation provided in the *San Fernando* is very complete for a vessel of this type, each officer being provided with a separate cabin. There are, in addition, on the bridge deck five double berth staterooms for passengers or officials of the company. Separate messrooms

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are provided for passengers, officers and engineers. The public rooms, staterooms and lounge are panelled in mahogany. Each cabin is fitted with patent ventilators and fans, and all sidelights and ventilator openings are provided with mosquito screens. A complete installation of steam heating is also fitted in all accommodations. The officers are berthed in the midship deckhouse, the engineers and crew being quartered in the deck house aft, alongside the engine casing. A comfortable smoking room is fitted in the upper bridge deck house, and accommodations for four apprentices are provided.

The refrigerating chamber, cooled by a refrigerating plant of the carbonic anhydride type, is fitted aft.

The *San Fernando* is fitted with a complete Marconi wireless installation, the wireless room being on the upper bridge deck, and accommodation for two wireless operators adjoins this cabin. The boat outfit comprises four large lifeboats and two cutters, two lifeboats being fitted on the bridge deck, while the remaining boats are on the poop deck aft, Welin patent davits being fitted for all boats. Two powerful steam capstans are fitted on the shelter deck aft for maneuvering and warping purposes. The patent hand and steam controlled steering gear is fitted in the after shelter between decks and is of the Wilson-Pirrie type, actuated by telemotor from the wheel house. A docking telegraph is also fitted on the poop deck.

Floating Electric Welder

A New Development for New York Harbor Designed, Built and Maintained by the Vulcan Iron Works, Inc.

BY R. ROYAL ROANE*

THERE was never a time in the history of our country when sound and logical industrial organizations were so necessary as today, not only as it applies to the individual industrial unit, but to industry as a whole. The problems of reconstruction and development are many and diversified; more production is absolutely essential in all branches, and the shipping industry of this country is well on its way towards the accomplishment of this end.

Never previous to the war has such an interest been taken in New York harbor in the problem of floating electric welders as at the present time, and while this is to a certain extent due largely to the volume of Emergency Fleet Corporation ship and boiler repair work, it is essentially an outcome of the normal process of evolution. There are now very few, if any, marine engineers and shipbuilders in this country (especially those doing repair work) who are not thoroughly convinced that a floating electric welder barge is a prime requisite to their organization.

The most interesting feature of this development from the standpoint of the marine engineer is, perhaps, that almost every firm of note is producing or maintaining some kind of electric welding plant, either stationary or floating, to take care of its large volume of repair work.

It is a well known fact that during the recent war the demand for ships and more ships was the paramount consideration, and all branches of the engineering profession and mechanical trades were brought into the work, which quite naturally (due to the inexperience and forced production) meant inefficiency in workmanship, which necessitated numerous repairs to ships, hulls and boilers in order to get them ready for sea duty, all of which met the emergency admirably.

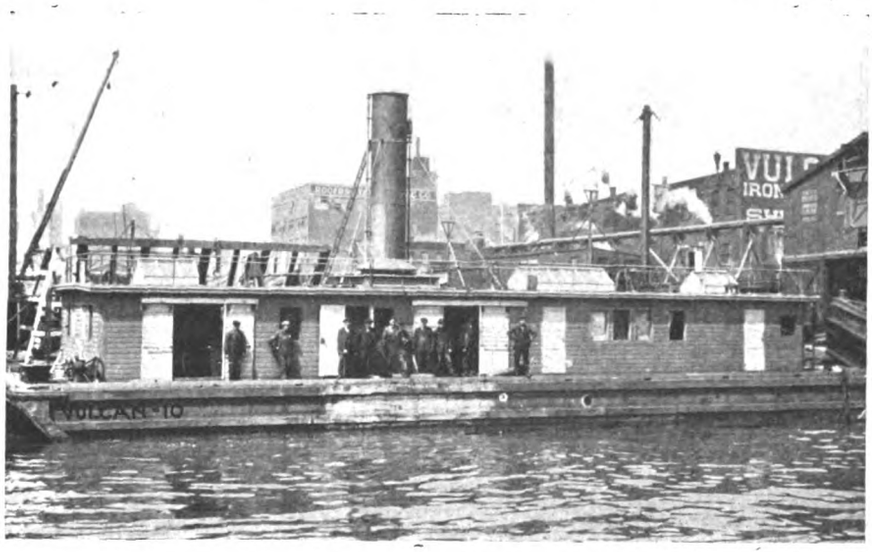

Fig. 1.—Electric Welder Barge *Vulcan-10*

Practically all of these ships in service during the war were forced to the limit of their capacity, and no time was allowed for overhauling and repairs, which are extremely necessary in ship operation; consequently, when the armistice was signed and service reduced, the ships came in by the dozens and hundreds, and all repair yards were flooded with work. Many ships unable to find berths were repaired while lying at anchor in the harbor.

This development of industry as a unit and as a whole is much more of an engineering problem than will be apparent on first analysis. Engineering knowledge properly co-ordinated and adroitly manipulated is the foundation of our industrial structure. The engineering mind, trained in the use of facts and thinking in terms of cause and effect, is the mind best fitted to solve the complex problems confronting modern industrialism.

The shipping industry of this country is a large one, and increased production naturally means more maintainance and repairs. With this end in view, designers and engineers were prompted to develop a floating electric welder barge of this particular class.

* Chief engineer, Vulcan Iron Works, Inc., Jersey City, N. J.

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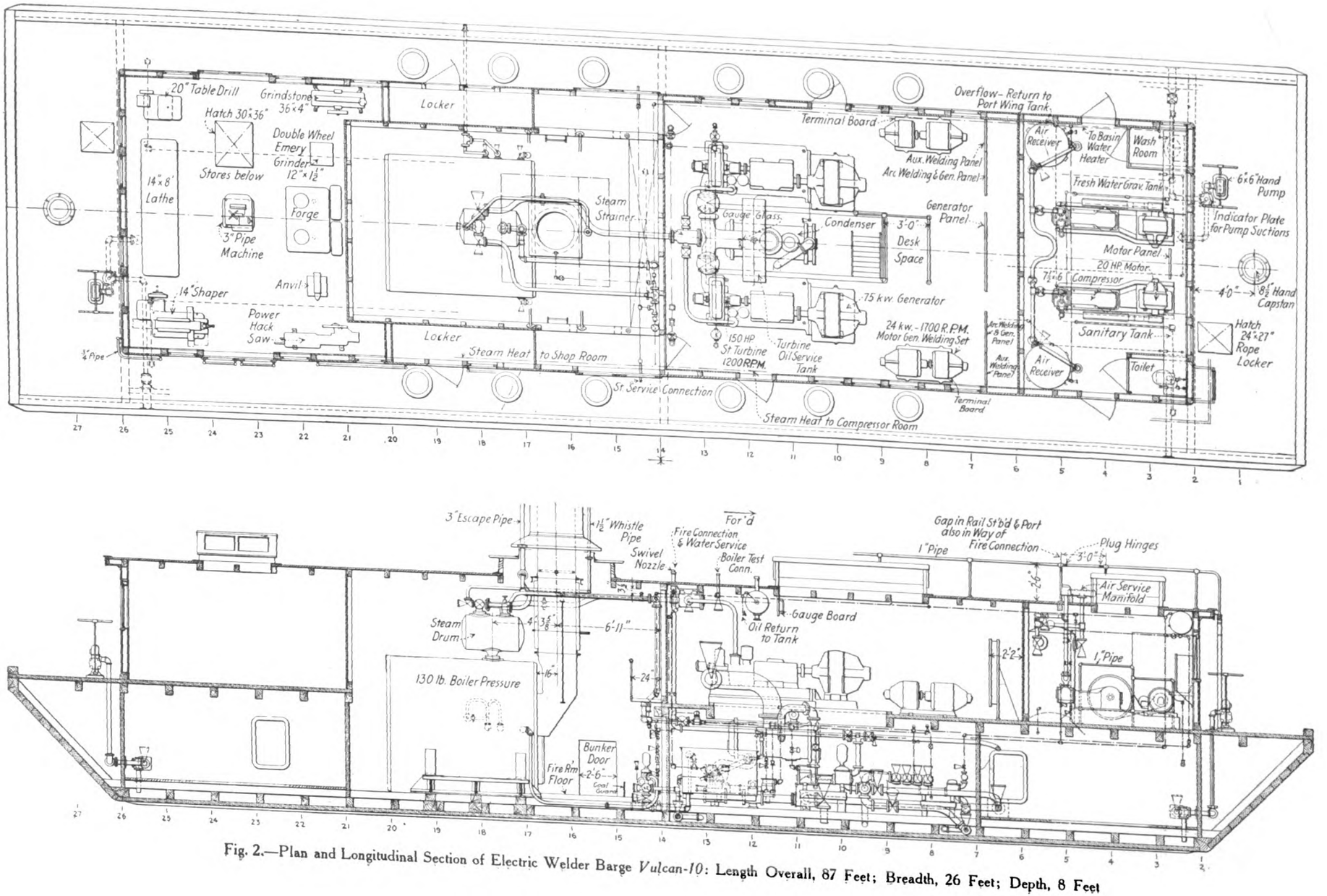

Fig. 2.—Plan and Longitudinal Section of Electric Welder Barge *Vulcan-10*: Length Overall, 87 Feet; Breadth, 26 Feet; Depth, 8 Feet

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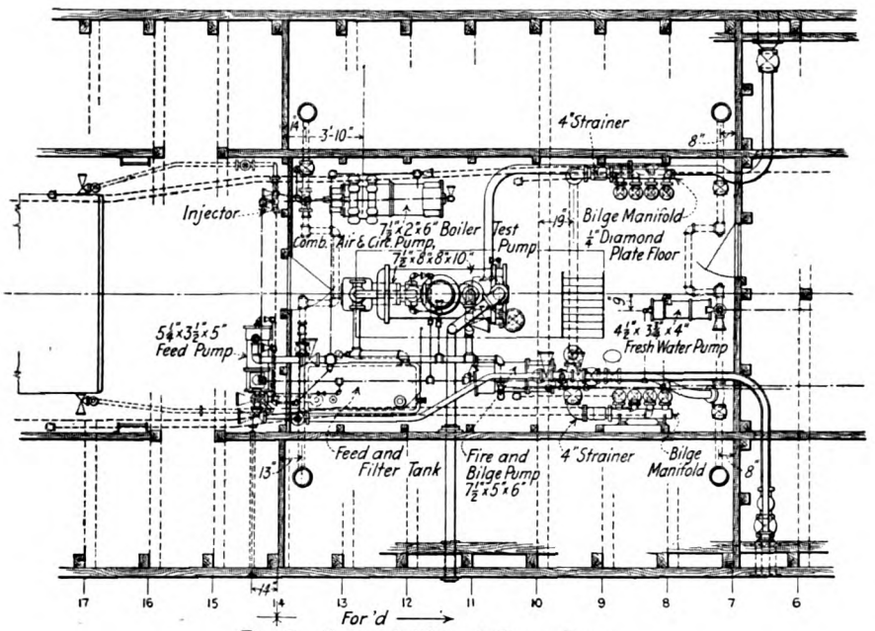

Fig. 3.—Sectional Plan of Pump Room

This particular development has many advantages for repairing ships and doing boiler work while the ship is at anchor. The barge can be towed to the ship and lashed alongside and remain at work night and day, the barge having fuel and fresh water capacity sufficient for an intermittent service of ten consecutive days; if necessary, the men may be berthed and messed aboard the ship they are working on along with the ship's crew.

The hull of this welder as shown on the accompanying plans is built of timber construction, long leaf yellow pine, of the following dimensions:

Length overall	87 feet
Length on bottom	73 feet
Rake at ends	7 feet
General outside plank	26 feet
Depth including deck and bottom planking	8 feet
Load draft	4 feet 2 inches
Camber of deck	2 inches

Built straight with no sheer.

The deck house has a length of 71 feet 8 inches and a width over plank of 18 feet 8 inches. The height at the sides is 8 feet, the camber of roof 2 inches. The projection of the roof eaves over the house, all around, is 12 inches.

This welder carries a Scotch marine single-end type boiler, 9 feet in diameter, 10 feet long, with a steam drum on top, equipped and built to the requirements of the United States steamboat inspectors, with two Morison corrugated furnaces and 3-inch steel tubes. The boiler has a combined heating surface of 1,075 square feet, a grate area of 33½ square feet, and is equipped for burning coal under natural draft conditions.

The main units of this barge will consist of two 75-kilowatt, 100-horsepower, turbo-driven generating sets with DeLaval geared turbines and General Electric direct-

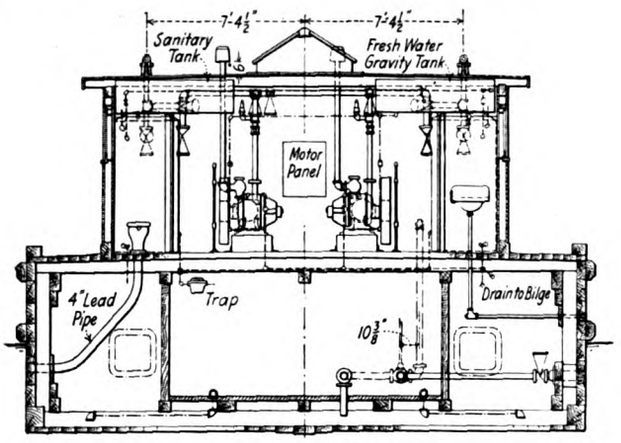

Fig. 4.—Section at Frame 2

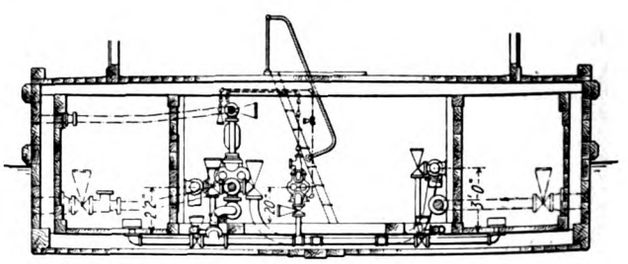

Fig. 5.—Section at Frame 7

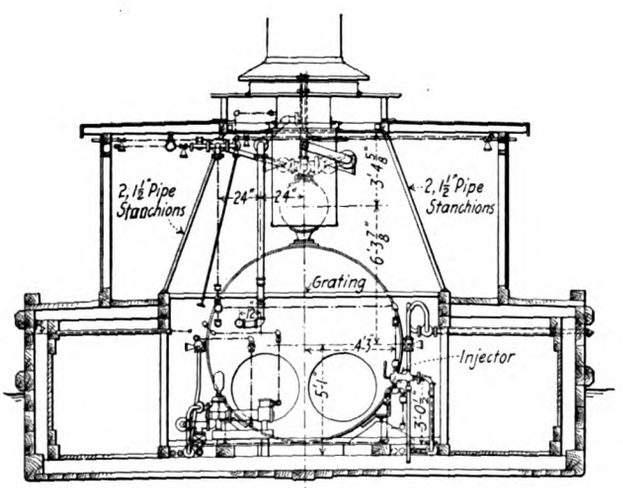

Fig. 6.—Section at Frame 14

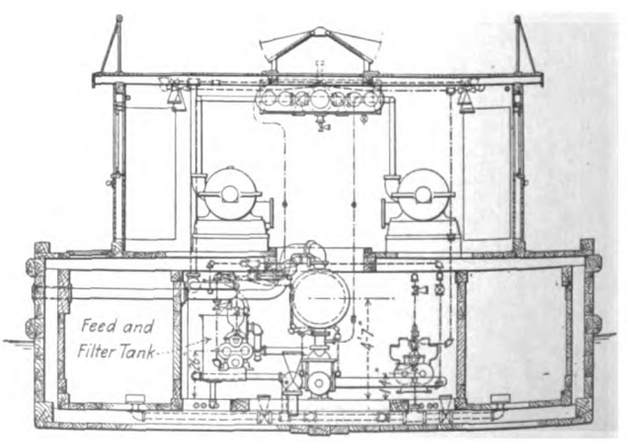

Fig. 7.—Section at Frame 10

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current generators for 125 volts, with a steam consumption of 23 pounds per brake horsepower hour. These sets can be worked either singly or in parallel. They exhaust into a surface condenser having a cooling surface of 500 square feet, mounted on a combined air and circulating pump. The pump room carries a boiler feed pump, injector, feed and filter tank, general service and bilge pump, fresh water pump and a 700-pound test pump for testing boilers.

ELECTRIC WELDING UNIT

The electric welding unit is to consist of two 400-ampere, constant potential arc welding sets of the General Electric make, consisting of a 24-kilowatt, 60/60, 1,700 revolutions per minute, compound-wound generator, all mounted on a common base and direct-connected with one 40-horsepower, 125-volt, direct-current motor, all complete with the main control panel and the usual fixtures, one auxiliary panel, starting rheostats, instruments, etc.

Each set is designed to operate two 200-ampere metallic electrode circuits with connections on both sides of the barge, with sufficient wiring for distribution to any part of the ship.

A general switchboard is provided with all necessary fixtures for the accommodation of electric lights aboard the barge, with junction boxes on each side of the barge to supply the ship undergoing repairs either with electric current direct to their main circuit or with portable lights sufficient to do repair work.

The barge is equipped with storage space for carrying oxy-acetylene welders and burners to cover welding repairs where the acetylene flame work is necessary.

One section of this barge is equipped with an air compressor room, with two 100-foot, free air Laidlaw motor-driven compressors, with two large air receivers cross-connected for air service on both sides of vessel. This compressed air is provided for the use of all air tools in connection with repair work of any description.

FULLY EQUIPPED MACHINE SHOP PROVIDED

At the after section of the deck house is located a fully equipped machine shop with the following tools: Engine lathe, vertical table drill, crank shaper, pipe-threading machine, power hack saw, double forge and anvil, and tool grinder and grindstone, all of which are direct-connected with 125-volt, direct-current, variable speed motors.

The demand for this particular class of floating welder barge is very great, in all probability due to its very wide scope of work. In many cases it is not only a question of making repairs to leaky butt straps or joints on the boilers, but it often becomes necessary to replace staybolts, which makes necessary the hack saw, drill press, lathe and air tools, and the replacing, grinding and fitting of new valves, new rivets, overhauling berths, lockers, quarters in general, new calking, testing and a general line of repairs, all of which require a full equipment of machine shop facilities.

The accompanying plans show the general layout of the hull and installation of machinery and piping, which will give an idea of the full design and construction of this particular unit.

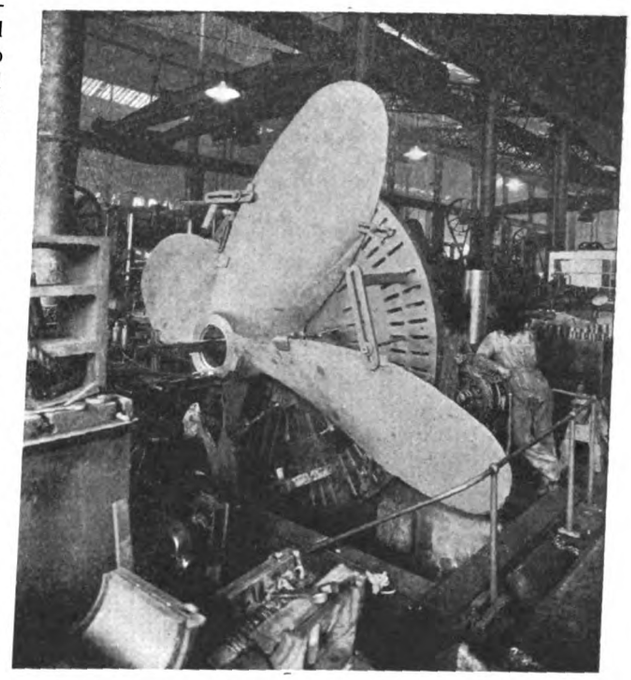
The deck is equipped on each end with a handy billy pump for emergency bilge and fire service, hand capstans, towing bitts, fire hose connections, steam hose connections and air hose connections.

The general layout is roomy, with plenty of windows and skylights, which means air, daylight and sunshine. Modern plumbing facilities are provided aboard the barge for the convenience of the crew.

An Unusual Propeller Job

THE illustration shows an 18-foot diameter, four-bladed, bronze propeller cast in one piece and weighing 22,420 pounds, being bored on the pit lathe at the Union plant of the Bethlehem Shipbuilding Corporation. This propeller was cast at the Union plant for the Moore Shipbuilding Company to be used on the steamship *Howick Hall,* now being repaired at Moore's yard.

It will be noticed in the picture that the tool rest is supported by a swivel stand, so that the guides can be set at the taper required for the hole to be bored. The feed of the tool into the hole is worked by a small independent motor and screw gearing.



18-Foot Diameter Bronze Propeller, S. S. *Howick Hall*

It is a rather unusual practice for a propeller of this size to be cast in one piece, and the capacity for this kind of work at the Union plant of the Bethlehem Shipbuilding Corporation is a great asset to shipping facilities in San Francisco harbor. In fact, it is doubtful whether anywhere else on the Pacific coast this work could have been undertaken without some special machinery being set up or built for the job.

Harbor and Waterway Projects Urged

A resolution adopted by the United States Chamber of Commerce at its eighth annual meeting at Atlantic City calls upon Congress to make appropriations ample for improvement and maintenance of commercially meritorious harbor, river-channel and canal projects. The resolution reads:

"Waterways afford opportunities for increasing the facilities of transportation available to our industries and commerce. Immediate needs for movement of fuel, materials and products require that Congress should at once make appropriations ample for improvement and maintenance of commercially meritorious harbor, river-channel and canal projects which it has approved and which have the interrelation with one another or with other means of transportation that is essential for routes of traffic."

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British Battle Cruiser Hood*

Original Design and Later Improvements—Additional Protection Provided—Propelling and Auxiliary Machinery—Comparison With Pre-War Dreadnoughts

BY SIR EUSTACE D'EYNCOURT, K.C.B.

INSTRUCTIONS to prepare designs of battle cruisers embodying the latest ideas in regard to underwater protection, speed, etc., were issued by the Admiralty in 1915. A considerable number of designs were submitted to the Board, but as there were no large berths available, it was not possible to place an order before the spring of 1916, and in March of that year the Board selected a design of the dimensions given below to be worked out in detail. This design formed the original basis for the design of the *Hood*, having the same length and breadth as the *Hood*, but of considerably less draft, viz., 25 feet 6 inches normal and 29 feet deep, with a displacement of 36,300 tons on a length of 810 feet between perpendiculars. The speed was to be 32 knots, with machinery of 144,000 shaft horsepower. The armor, which was approximately equivalent to that of *Tiger*, consisted of an 8-inch belt and 9-inch barbettes. The armament was to be eight 15-inch guns and sixteen 5½-inch guns, together with two 21-inch submerged torpedo tubes.

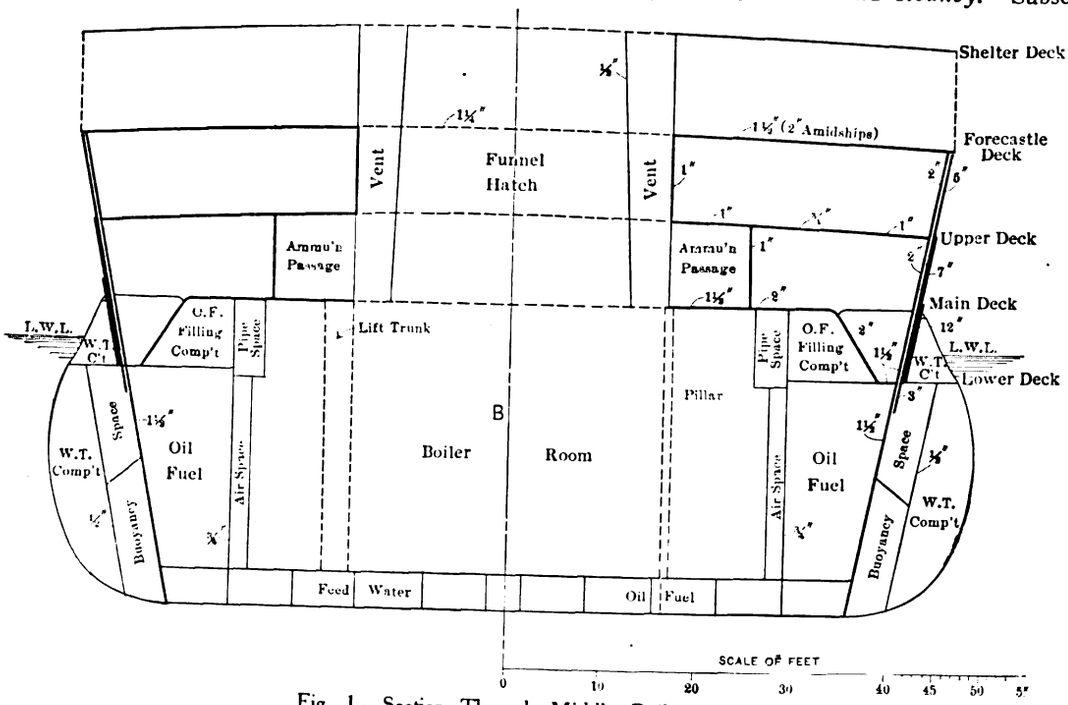

Fig. 1.—Section Through Middle Boiler Room

First Capital Ship Fitted with Small-Tube Boilers

I strongly advocated the adoption in this design of small-tube boilers, and these were accordingly included for the first time in the design of a capital ship. This feature had the most marked influence on the whole design, on account both of the smaller space occupied and the reduced weight involved, as compared with the space and weight which would be necessary for the large-tube boilers which had hitherto been adopted in all our big ships, including the *Renown* and *Repulse*. The first big ships, though they cannot be regarded as capital ships, as mentioned above, which had the small-tube boilers were the *Courageous*, *Glorious* and *Furious*.

The original design of *Hood* was approved by the Board in April, 1916, and orders were placed to build one ship each with Messrs. John Brown, Messrs. Cammell Laird, and the Fairfield Company, the ships being named respectively *Hood*, *Howe* and *Rodney*. Subsequently an order for a fourth ship, H.M.S. *Anson*, was placed with Messrs. Armstrong.

It will be remembered that the battle of Jutland took place on May 31, 1916. This, the greatest fleet engagement of modern times, naturally led to further consideration of the design of the *Hood*, which had only just been ordered; and, in view of the damage which was done to our own battle cruisers and also to the German ships of similar type, it was deemed advisable to increase the armor protection if possible. As the result of very extensive investigations, it was found possible, by accepting a deeper draft and a slightly reduced speed, to add very considerably to the protection of the vessels as already designed, without serious modification to the design of the ship as a whole. Accordingly, in September, 1916, definite proposals for increased protection were submitted. The alterations were of a very radical character, the armor belt being increased from 8 to 12 inches and the barbettes from 9 to 12 inches, and certain increases were also made in the deck protection. The particulars as thus finally decided are given in Table I. At the same time the eight 15-inch gun mountings had their design modified to admit

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of an elevation of 30 degrees, and certain other modifications were made both in the torpedo armament and also in the arrangements for preventing the flash penetrating to the magazines—a form of protection which was elaborated for all our ships at this time. All these increases involved an additional weight of nearly 5,000 tons, the legend displacement of the *Hood* becoming finally 41,200 tons when carrying 1,200 tons of fuel, the ship then having a draft of 28½ feet and a draft of 31½ feet with full fuel load, viz., 4,000 tons.

The original length and beam of the ship were maintained as before. Some extra plating had to be provided on the decks for strength purposes, but the underwater protection against torpedoes, which had proved very efficient, was retained, as in the original design. I should mention also that the stability conditions were such that the increased displacement could be accepted while still maintaining a very satisfactory metacentric height.

All the modifications made in the design after the battle of Jutland were considered in consultation, not only with the Board of Admiralty, but with the Commander-in-Chief, involving, as they did, special arrangements for the fire and torpedo control, arrangement of bridges, etc., and it was not untill 1917 that the design was finally approved in all its details. This change naturally militated against the quick construction of the ship, and it will be about four years from the approval of the original design in April, 1916, to the time of her completion, this being about double the time taken to build our recent capital ships, and nearly three times that taken to build H.M.S. *Repulse* and *Renown*. It is only fair, however, to say that the modifications were quite justified by the circumstances, and they have no doubt made the ship a much more powerfully protected one, while increasing her displacement, and consequently the weight of material to be worked, to about 50 percent more than that of *Repulse* and *Renown*.

Propelling Machinery

The main machinery, consisting of geared turbines to develop 144,000 horsepower, is the largest power which has ever been put through gearing, namely, 36,000 horsepower on each of the four shafts. The machinery is placed in three engine rooms, of which the forward one contains two independent sets for the outer shafts, the middle and after engine rooms containing one independent set for each of the inner shafts. This power, which was designed to give 32 knots for the earlier design of 36,300 tons displacement, is expected to give at least 31 knots in deep water at a displacement of 41,200 tons for the *Hood* as built. At the extreme deep load draft of about 31½ feet, a speed of between 30 and 30½ knots should, I think, be realized.

The revolutions per minute of the propellers are to be 210 at full speed, and this admits of the adoption of propellers of higher efficiency than many we have had in our capital ships before gearing was introduced, when the revolutions were considerably higher. A good performance may, therefore, be confidently looked for on the speed trials of *Hood*.

The boilers, twenty-four in number, as mentioned above, are of the small-tube type with forced draft and are arranged in four boiler rooms. It was known that a great number of the later German capital ships took advantage of the reduced weight and space occupied by small-tube boilers and have generally adopted them in their recent designs. It is hardly necessary to say that oil is the only fuel used in *Hood*.

TABLE 1.—LEADING PARTICULARS OF H.M.S. *HOOD*

Length between perpendiculars	810 feet
Length overall	860 feet
Breadth, extreme	104 feet
Load draft (load waterline), mean.	28 feet 6 inches
Displacement at load draft	41,200 tons
Shaft horsepower of engines	144,000
Speed at load draft	31 knots
Oil fuel at load draft	1,200 tons
Oil fuel capacity	4,000 tons
Armament	8 15-inch B.L. 12 5.5-inch B.L. 4 4-inch H.A. 2 21-inch T.T. submerged 2 double 21-inch T.T. above water
Armor—	
Side—Amidships	12 inches, 7 inches, 5 inches
Side—Forward	6 inches, 5 inches
Side—Aft	6 inches
Bulkheads, Forward and Aft	5 inches, 4 inches
Barbettes	12 inches
Gunhouses	15 inches, 11 inches
Conning tower	11 inches, 9 inches
Protection—	
Vertical plating, magazines, etc.	1½ inches
Forecastle deck, amidships	2 inches
Upper deck, amidships	1 inch
Main deck	1½ inches flat and 2 inches slope, increased to 3 inches over magazines
Lower deck forward	1 inch, 1½ inches
Lower deck aft	1 inch, 3 inches

WEIGHTS EXPRESSED AS PERCENTAGES OF DISPLACEMENT AT LOAD DRAFT

Item	Percent
Equipment	2.0
Armament	12.5
Machinery	13.0
Oil fuel	3.0
Armor and protection*	33.5
Hull*	36.0
	100.0

* The plating of the decks and sides is required to be of such thickness for strength that it contributes very materially to protection. The weight of this plating is, however, included in "Hull."

Main Armament

It will be seen from the plan Fig. 2 that the main armament of eight 15-inch guns is mounted, as in our recent battleships of the *Queen Elizabeth* and *Royal Sovereign* classes, in four turrets, all on the centerline. The heights of the axes of the guns above the normal load waterline for each turret, commencing from forward, are 32 feet, 42 feet, 31 feet 9 inches and 21 feet 9 inches. The big guns have very large arcs of training, the forward ones training to 60 degrees abaft the beam, and the after ones to 60 degrees before the beam.

The anti-torpedo boat destroyer armament consists of twelve 5½-inch guns with shields 1 inch thick, these guns being arranged on the forecastle deck and shelter deck as shown. There are also four 4-inch anti-aircraft guns on the shelter deck aft.

There are two 21-inch submerged torpedo tubes, each in a separate compartment forward, and four 21-inch above-water torpedo tubes between the upper and forecastle decks, these above-water tubes being a further addition since the original design was made.

Placement of Armor

The distribution of armor is shown in Fig. 1. The 12-inch belt has a length of 562 feet and a depth of 9 feet 6 inches. Above the main belt is a strake of 7-inch armor to the height of the upper deck, and above that again there is a 5-inch armor between the upper and forecastle decks. The side armor all slopes outward from below, as seen on the section, so that the virtual thicknesses are really somewhat greater, as the shell cannot thus hit the armor normally. There is thick plating behind all the armor, varying from 2 inches over the greater portion to 1¼ inches and 1 inch elsewhere.

The gun-shields for the turrets are of improved shape, with rather flatter roof than formerly, and the armor has a thickness of 15 inches in front, 12 inches and 11 inches

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on the side, with a thick roof plate. The conning tower arrangements have been very specially considered and arrangements made, in addition to the Admiral's conning tower, for torpedo and 15-inch gun control towers and 5½-inch gun control, revolving hood with range-finder, in addition to the range-finders provided in each turret. There are also smaller range-finders in connection with the different controls.

The torpedo protection consists of the bulge arrangement, with an outer compartment of air and an inner one specially strengthened with the necessary separating bulkheads, etc. This protection extends throughout the whole length of the machinery spaces and magazines, and it can be said that it renders the ship as safe against attack from torpedoes under water as she is against gun attack above water.

Origin of Under-Water Bulge Protection

It is a somewhat curious coincidence that the first series of recent experiments on under-water protection should have begun by a set of trials of torpedo charges against the old *Hood,* of the old *Royal Sovereign* class built in 1893. Developing the lessons learnt from these trials, which took place in the year immediately preceding the war, the bulge protection was first designed and fitted at the commencement of the war in the old cruisers of the *Edgar* type, to which I alluded in my last year's paper. A series of experiments was then made at the request of the Admiralty by the late Professor (afterwards Colonel) Bertram Hopkinson, F.R.S., in conjunction with myself, at first under the auspices of the Royal Society. These experiments, which were made on different scales, gradually working up to the full size, were of the greatest value, and the original protection fitted to the *Edgar* was modified and the details of construction as modified have been largely adopted in the *Hood.* I am glad to have this opportunity of paying special tribute to the work of Professor Hopkinson and to his memory.

It may be noted that no ship provided with the original or the later form of bulge was lost, nor even seriously damaged by torpedo attack during the war, nor was there loss of life in any case, this being chiefly due to the special form of bulge and to its being external to the ship proper. By careful attention to the form the reduction in speed is only that due to the added displacement, amounting in the *Hood* to only a fraction of a knot.

Experience and trials have shown that the *Hood,* as protected, can receive the blows of several torpedoes and still remain in the line without serious loss of speed.

In the design of the *Hood* special consideration had to be given to docking, and she is provided with double internal vertical keels along the centerline, and the docking keels come under the longitudinal bulkheads to support the ship on each side. Arrangements are made to dock the *Hood* in our larger docks, and she has already been docked and prepared for trials at H.M. Dockyard, Rosyth.

The *Hood* was successfully launched in August, 1918, at Clydebank, the ceremony being performed by Lady Hood, widow of Admiral Hood, who lost his life while gallantly leading into action the third battle cruiser squadron at Jutland.

Launching Weight and Girder Strength

The launching weight was about 22,000 tons. As the other three ships of the class which were commenced had none of them reached the launching stage at the time of the armistice, it was subsequently decided not to proceed with them, in view of the international conditions, and the *Howe, Rodney* and *Anson* were accordingly scrapped.

The general strength of the ship as a girder had to be thoroughly investigated, both the original design and again when the protection and displacement were increased. Assuming the ship among waves equal to her length from crest to crest and one-twentieth of that length in height (a condition which I do not think is ever likely to be met with) the maximum tensile stress on the top of the girder is less than 10 tons per square inch, and I may add that not one of our recent ships has ever exceeded this amount, although a slightly greater stress has been accepted in some recently designed Atlantic liners. The maximum tensile stress on the keel is less than the above, and the maximum compressive stress does not exceed 9 tons per square inch.

Auxiliary Machinery

The following are some particulars of the general outfit:

Eight dynamos are provided and are widely separated; two are driven by Diesel engines, two by turbo engines, and four by reciprocating engines.

Four hydraulic pumping engines are provided for working the turrets; these and the other more important auxiliary engines are kept well away from the ship's side, as are also the necessary feed tanks.

Pumping and Flooding Arrangements

Special consideration has been given to this item in the design of the ship, electrical bilge pumps have been provided, and also some 100-ton submersible pumps to deal with any water that may enter the ship. For fire and wash deck purposes a fire main is run all fore and aft under protection with rising mains at intervals. This fire main is charged from the 50-ton electrical pumps, and also from the 75-ton steam-driven fire and bilge pumps in the engine and boiler rooms.

In the boiler rooms 1,000-ton turbo pumps are fitted; in each engine room the circulating pumps are arranged to draw from the bilges instead of from the sea, if required. Steam ejectors, each of 300 tons capacity, are provided in the auxiliary machinery compartments and submerged torpedo rooms.

The steering gear is of the right- and left-hand screw type, with connecting rods attached to a crosshead on the rudder head. Two steering engines are placed in the after engine room with shafting led through the shaft passages and thence aft to the steering gear. Auxiliary steering on the Williams-Janney principle worked by electric motor is placed in the after steering compartment.

The main telemotor system is continued aft, so that this gear can be worked from the main steering positions of the ship. The following steering positions are provided: Conning tower, lower conning tower, after engine room, steering compartment (auxiliary only).

Steering by hand power is not provided, as it has proved to be of little value with these very high-speed ships.

The anchors, three in number, each weigh 9½ tons, and the chain cable is of 3⅜-inch diameter. Two cable-holders and a middle-line capstan are provided, all connected to the capstan engine. A third cable-holder is provided for the sheet cable for letting go only. At the stern a 3-ton anchor is provided, and the after capstan is worked by Williams-Janney gear driven by an electric motor.

Special attention has been paid in our more recent ships, and perhaps more than any in H.M.S. *Hood,* to the system of ventilation, which has been worked out on the latest and most scientific principles, a great deal of experimental and research work having been done to get the best results. The main points to be noted are as follows:

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The engine rooms are ventilated by four 30-inch and three 40-inch supply fans, and four 35-inch and two 50-inch exhaust fans, electrically driven. Each of the auxiliary machinery compartments has two 17½-inch electrically-driven exhaust fans with "natural" supply trunks, all openings being well above the weather decks, in order that ventilation may go on as usual, even in bad weather—a very important point for the comfort and health of the crew. A very complete system of ventilation has been supplied to the seamen's heads and to all w.c.'s, pantries, sculleries, paint stores, washplaces, etc., the ventilation being general by means of exhaust fans leading direct to the open air. The living spaces generally are ventilated by trunks supplied by electrically-driven fans. These trunks have openings so arranged that the air is delivered at a low velocity, and strong drafts which might be objected to are thus avoided and a gradual supply of fresh air, keeping the whole place sweet, is thus ensured. Where necessary, the air is passed through steam heaters for purposes of warming. In all these arrangements care has been taken to maintain as far as possible the transverse watertight subdivision of the ship, by avoiding the piercing of watertight bulkheads. Each of the main transverse compartments is accordingly ventilated independently of any of the other main compartments, and thus the risk of water finding its way from one compartment to another in case of damage is eliminated.

In all our recent designs, great attention has been paid generally to the accommodation and comfort of the officers and men. Just before the war a special committee was appointed to inquire into the accommodation of ships, and their recommendations have been embodied in the *Hood*.

Boat hoists, fitted with variable speed control gear of the Williams-Janney type, driven by electric motors, are provided, and a weight of 16 tons, that of the heaviest boat, can be lifted and lowered at a rate of 60 feet per minute.

General Design

As regards the general design of the ship, the *Hood* may be cited as an example of what can be achieved by going to a large size. The endeavor has been in her design to embody the armament and armor protection of a first-class battleship, including also good under-water protection against torpedoes, and at the same time to give her the speed of the fastest battle cruisers. It has only been possible to do this by going to a great length and displacement. The under-water bulge protection is additional to anything provided in our pre-war dreadnoughts, although these ships had internal bulkheads. The addition of the bulge, which has entirely superseded the provision of torpedo netting, involved a considerably increased weight over and above that of a ship of ordinary form, and although this additional weight was accompanied by a somewhat greater amount of additional buoyancy, it still involved an increased displacement with the accompanying increase in resistance to propulsion.

It may be argued that in such a large ship a great many eggs are placed in one basket, and that a very expensive one, but it would have been quite impossible to combine the speed, armament and protection in a smaller unit.

In connection with the size of the *Hood* and general considerations of design, it is, I think, interesting to note that of recent capital vessels built, and taking the chief characteristics of two classes of about the same displacement, in *Queen Elizabeth* we had a well-armored ship of about 28,000 tons with eight 15-inch guns and speed of 25 knots. In the *Renown* and *Repulse*, of slightly less displacement, viz., 27,000 tons, though of greater length, we had vessels with 7 knots more speed than *Queen Elizabeth*, but with only six 15-inch guns against eight, and approximately about half the arbor protection provided in the *Queen Elizabeth*. In the *Hood* we are providing the same armament, viz., eight 15-inch guns, as in the *Queen Elizabeth*, armor protection fully equal to, and in fact rather heavier in the aggregate than that of the *Queen Elizabeth*, 6 knots more speed than the *Queen Elizabeth*, which makes the speed nearly equal to that of *Renown* and *Repulse*, and in addition a full bulge protection against torpedo attack.

American Battle Cruisers Modified

It is of interest to note that the American battle cruisers, which were originally designed with very light armor protection, have recently been modified in the direction of additional protection, making them thus more like the *Hood*, and in the annual report of the chief of the Bureau of Construction and Repair for the fiscal year 1919, he says: "On June 24, 1919, the General Board recommended that battle cruisers be built as a distinct type, but the designs be changed to provide materially greater protection against gunfire and under-water attack, the resulting increase in displacement and reduction of speed, probably less than 2 knots, being accepted." This was approved, and the new plans necessary were got out. It is, I think, satisfactory that the American authorities, who have had full knowledge of what we have been doing in this country in the design and construction of warships, should have thus come to the conclusion that we were on the right lines, and have modified their designs accordingly.

As regards cost, which is about 6 millions, this, of course, is an enormous sum, but when the displacement and size of the ship and her qualities are considered, I do not think it is very excessive, in view of the present increase in prices. Most things have doubled in cost, and many of our pre-war capital ships, complete with their armaments, etc., cost on the average about $440 (£90) a ton of displacement. The *Hood* is costing about $707 (£145) per ton, or an increase of only 60 percent above pre-war prices, although she has qualities possessed by no earlier capital ship.

Large Submersible Warships Impracticable

A good deal has been written and talked of lately about the surface capital ship being dead and the necessity for submersibles. But with our present knowledge it would be quite impossible to design a submersible ship which on the same displacement and cost had anything like the fighting qualities on the surface which are possessed by the *Hood*. Every ship is a compromise, and if in addition to the ordinary qualities of a battleship she is required to submerge, or even partially submerge, a very considerable percentage of weight has to be added to give her this additional capability of submergence. She becomes still more of a compromise, and the added weight must detract from the fighting qualities of the ship when on the surface, so that whatever is done, other things being equal, the submersible ship must be inferior to a surface ship in an ordinary action. There are many difficulties of details in the design of a submersible battleship which would take too long to go into fully now, and although there is no doubt that submarines are capable of great development, a little thought will make it clear to anybody that if naval warfare is to continue, the surface ship of the line must still hold the field as the principal fighting unit of any great navy. This view is apparently shared by other countries who are developing their navies, and both Japan and the United States are building large capital surface ships.

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Notes on the Dimensions of Cargo Steamers*

BY JOHN ANDERSON

In a paper read by the author before the Institution in 1918 on the most suitable sizes and speeds of general cargo steamers, it was indicated that to obtain the best financial results from such steamers, working under unrestricted conditions of draft and of quantity of cargo available, the dimensions, or total capacity of the vessel, should be in some proportion to the ratio of steaming time to total time on service and also to speed of the vessel. The statement was then made that large dimensions coupled with the greatest economy were dependent upon either a relatively long voyage or a rapid system of loading and discharging. The present notes are an extension of the former paper and are intended to indicate the best proportions of depth and breadth for the lengths already obtained under different conditions of loading and length of voyage.

IT is known that the cost of a vessel is reduced per ton of deadweight as the $\frac{\text{length}}{\text{depth}}\left(\frac{L}{D}\right)$ ratio is reduced; also, and particularly in low speed vessels, that the power and fuel consumption is reduced per ton of deadweight as the disposal of displacement is increased depthwise. It is therefore obvious that a relatively short and deep vessel would be the most profitable on a long voyage.

A vessel of large displacement might be found proportionately profitable on a relatively short voyage, but such

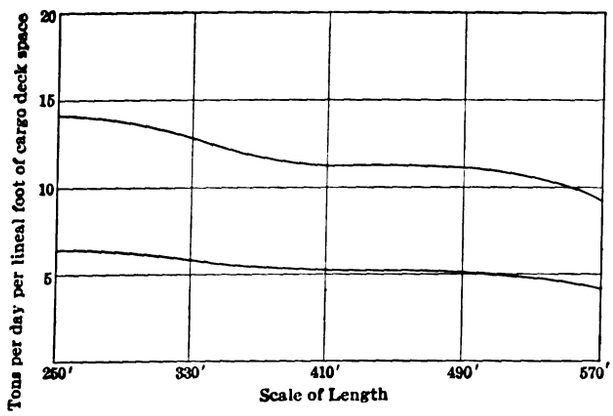

Fig. 1.—To Show the Loading Speed per Lineal Foot of Deck Given by the Derrick Systems Which Were Assumed for the 1918 Paper

a displacement could only be justified by a very rapid "turn round" or cargo handling speed. This factor would be largely influenced, in many cases, and particularly in vessels with slow discharging units, by the lineal fore and aft distance available for working the cargo. It is therefore conceivable that to obtain the best results on a short run for vessels whose time in port is fixed entirely by the time required for loading and discharging cargo it might be found advantageous to sacrifice some of the advantages claimed for deep ships on long runs by disposing the displacement lengthwise, so that additional cargo gear could be arranged per unit of cargo. Such a disposition as this has been practiced in the design of vessels carrying ore on the Great Lakes of America (notably the *Horace S. Wilkinson*, the dimensions of which are 588 feet by 60 feet by 32 feet, which gives a $\frac{L}{D}$ ratio of 18.4), also for vessels engaged on the coastal trades of South America and China.

In order to ascertain the extent to which proportions should be varied for vessels engaged on voyages of varying duration and for different loading speeds, calculations have been made for vessels having what is considered the minimum lengths of erections, i. e., a short poop and forecastle and a bridge covering the machinery casings and the officers' accommodation. Vessels with such erections will probably represent the cheapest type of seaworthy cargo carrier, and will have, at the same time, the maximum amount of flush deck length for the working of cargo.

The results presented in the writer's earlier paper were for vessels of the "well deck" type, having erections covering 50 percent of the length, with $\frac{L}{D}$ ratios of 13½ and with breadths of one-tenth of the length + 12 feet.

Basis of Investigation

The lengths now used are the same as those adopted in the paper referred to, viz., 250 feet, 330 feet, 410 feet, 490 feet and 570 feet, and the corresponding breadths are the same. Alternative ratios for $\frac{L}{D}$ of 11 and 15 are now used, and it is submitted that these combined with the earlier calculations will give the desired information.

With such changes of depth there will be an excess of stability in the case of the shallow vessels, and a deficiency in the case of the deep vessels. On this account additional calculations have been made to show the effect of adopting a breadth of $\frac{L}{10}$ + 8 feet for the shallow vessels and a breadth of $\frac{L}{10}$ + 16 feet for the deep vessels. These additional calculations have been made for several conditions and are shown on Fig. 3 for speeds of 10 and 14 knots and a voyage of 1,000 nautical miles.

It should be noted that a $\frac{L}{D}$ ratio of 15 is considerably in excess of that allowed by the classification societies for seagoing tonnage with normal scantlings, but, by the courtesy of the chief ship surveyor of Lloyd's Register,

* A paper read before the Institution of Naval Architects, London, March 25, 1920.

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it has been possible to ascertain the probable minimum scantlings which might be accepted by that society for future vessels should such proportions be found advantageous.

The calculations have been made for distances of 600, 1,000 and 4,000 nautical miles and for speeds of 10, 12 and 14 knots.

In the earlier paper the time in port was calculated from the number of winches and derrick systems which could be worked at each cargo hatch, and upon assumed working speeds for that type of cargo gear, but as the distance between each ordinary cargo hatch is approximately the same for each size of vessel, it was decided in this case to calculate the time in port as proportional to the lineal feet of deck available for working cargo. By this new process special types of vessels can be dealt with such as those with short hatches through which the cargo is worked by continuous cargo gear. Alternative calculations have been made for loads 6, 12, 20 and 34 tons per lineal foot per day. In order to show how these loads compare with the earlier calculations, Fig. 1 has been prepared, which shows the comparative values given by ordinary derrick gear, and it will be seen that the variation shown for these is produced principally by the H value, which was defined in the earlier paper and is the distance through which the cargo has to be transported. Table I also indicates what the total lifting power per day is under these new assumptions.

TABLE I

Length of Vessel	Total Tons Handled per Day			
	At 6 Tons per Foot	At 12 Tons per Foot	At 20 Tons per Foot	At 34 Tons per Foot
250	780	1,560	2,600	4,420
330	1,175	2,350	3,920	6,650
410	1,560	3,120	5,200	8,840
490	1,890	3,780	6,300	10,700
570	2,190	4,380	7,300	12,400

The variation given by the H value might be taken for all the cargo-handling gear which is generally in use, such as derricks, cranes or grabs. With special appliances such as grain elevators, the "Donald" type of cargo transporter, or other similar appliances which have continuous discharging facilities, a uniform rate per lineal foot such as is now proposed would, however, be most applicable.

The bases used for initial cost, allowances for holidays and repairs, depreciation, fuel consumption, profit, tonnage dues and wages are exactly similar to those used in the earlier paper, and it is assumed that if present-day figures were substituted they would not alter the relation of these factors to each other, but in any case it is submitted that the earlier calculations have shown that moderate variation in any one item will not seriously affect the result which is sought.

Curves for the various conditions have been drawn (and some of these are illustrated on Figs. 2, 3 and 4) giving values respectively for 600 nautical miles and 6 tons per lineal foot, for 1,000 nautical miles and 20 tons per foot, and for 4,000 nautical miles and 6 tons per foot per day.

RESULTS

The final results have been again expressed in terms of "freight rate" for a fixed amount of profit on the invested capital, and of "tons carried per annum" in relation to the initial cost of vessel.

By drawing the appropriate length line for each condition which comes within the limits of 570 feet length, at a position midway between the highest point of the "tons carried" curve and the lowest point of the "freight rate" curve, it is found that for a difference of $\frac{L}{D}$ ratio of 4 there is a difference in appropriate length of about 8 percent at 10 knots and 12 percent at 14 knots, the shallower vessels being the longer. The appropriate lengths given in the earlier paper for a ratio of 13½ can therefore be used and corrected for any required proportion. An increase in breadth has the effect of reducing the appropriate length, and it would appear that the most suitable size for a vessel could be stated in terms of displacement and speed upon a base of E_t, E_t being the ratio of steaming time to total time.

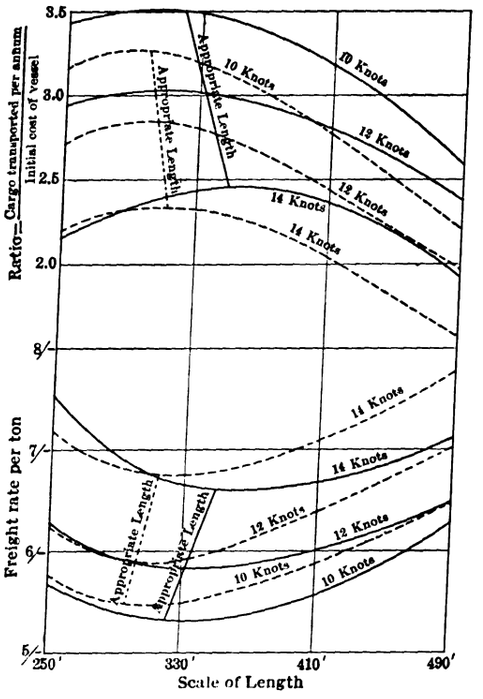

Fig. 2.—600 Nautical Miles and 6 Tons per Lineal Day

The calculated results show that for voyages of 600 miles in conjunction with a loading of 30 tons per lineal foot of cargo deck space, 1,000 miles and 21 tons, 1,500 miles and 13 tons or 2,000 miles and 6 tons, the balance is evenly held between low constructive cost per ton of deadweight and low power on one hand, as against the opposing factor of cargo deck space on the other. At these limits the proportions of depth or breadth can be varied widely without making any appreciable difference in the earning qualities.

With an increase of length of voyage or loading speed beyond these limits, the former set of considerations become predominant and a low ratio of $\frac{L}{D}$ associated with increased breadth would give the best results.

As the minimum speed for handling cargo is generally not less than 6 tons per foot of deck space, it would appear that the adoption of extreme proportions should not be considered for voyages of over 2,000 miles.

For voyages of less than 2,000 miles it is found that with loading speeds less than those indicated for the respective lengths of voyage there are slight advantages ob-

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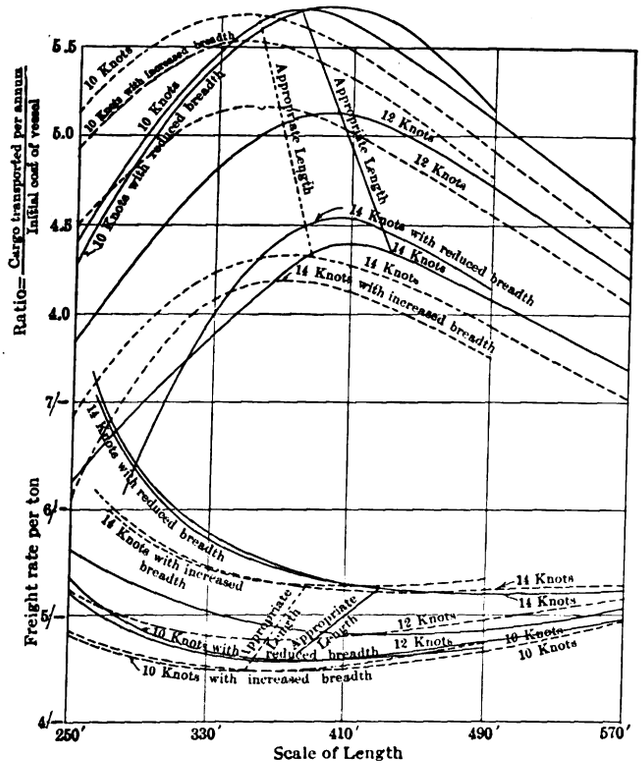

Fig. 3.—1,000 Nautical Miles and 20 Tons per Lineal Foot per Day

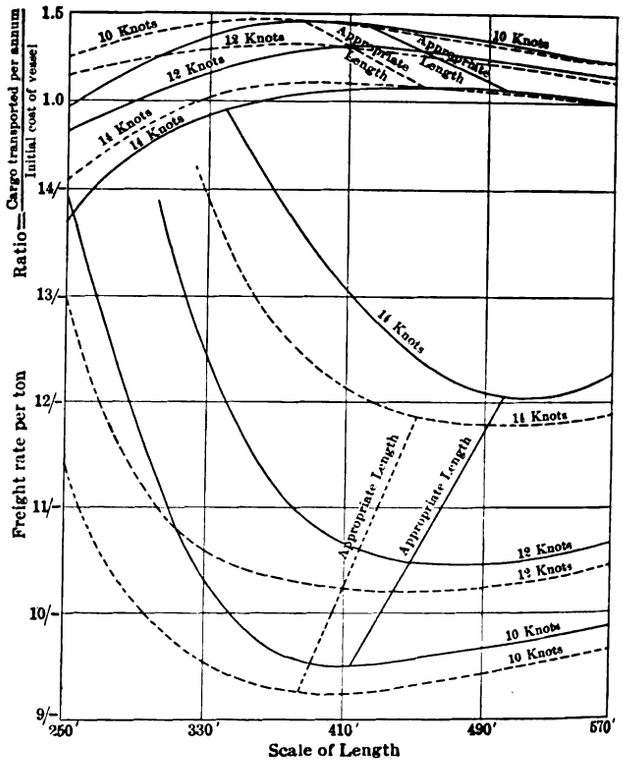

Fig. 4.—4,000 Nautical Miles and 6 Tons per Lineal Foot per Day

tained by adopting extreme proportions or reduced cross-section area, but at the appropriate lengths prescribed these advantages are so slight that no good purpose would be served by adopting such proportions.

If, however, it be found necessary to exceed the appropriate length as defined under these conditions, it may be then found more profitable to reduce the cross section area for vessels which are fitted with slow working cargo gear. If, on the other hand, a length which is less than the appropriate length is decided upon, an increase of cross section area will be advantageous. Figs. 2 and 3 bear out these remarks and show that on the left-hand side of the appropriate length line, increased cross section area will give increased earning power, while on the right-hand side such increases will reduce it.

This statement is borne out by the additional lines which are shown on Fig. 3, to illustrate the effect of modification of breadth.

In giving these results, the writer considers it desirable to repeat that if a vessel is required to make a return voyage in ballast trim, the ballast run should be considered as an extension of the main voyage, and that this consideration will have a bearing upon the proportions to be adopted. Similar remarks may be applied to vessels whose time in port is not fixed entirely by the time required to handle cargo.

It is not conveniently possible to show all the results of the calculations made, but in order to indicate the difference produced by change of proportions and cargo handling speed, Table II has been prepared for loading speeds of 6 and 20 tons, and it gives the values, as a percentage, for a ratio of length to depth of 15 in comparison

TABLE II

To Show the Freight Rates and Tons Carried with an $\frac{L}{D}$ Ratio of 15, in Comparison with Vessels of $\frac{L}{D}$ Ratio 11, the Basis of This Table Being 100 Percent for the Latter Proportion in Each Instance

Condition	10 Knots				14 Knots			
	Loading Speed per Lineal Foot of Cargo Deck Space per Day							
	6 Tons		20 Tons		6 Tons		20 Tons	
	Freight Rate	Tons Carried	Freight Rate	Tons Carried	Freight Rate	Tons Carried	Freight Rate	Tons Carried
600 Nautical Miles								
Appropriate length	97	107	99	105	97	104	99	105
85 per cent appropriate length	99	107	100	106	102	100	102	104
115 per cent appropriate length	94	112	96	106	94	114	96	111
1,000 Nautical Miles								
Appropriate length	103	101	100	101	97	104	100	104
85 per cent appropriate length	105	98	103	96	106	97	105	94
115 per cent appropriate length	101	103	102	106	92	112	99	105
85 per cent appropriate length and increased beam	—	—	104	99	—	—	106	97
115 per cent appropriate length and reduced beam	—	—	101	106	—	—	98	105
4,000 Nautical Miles								
Appropriate length	103	98	109	82	103	99	110	86
15 per cent appropriate length	105	91	109	82	107	90	110	86
115 per cent appropriate length	103	101	109	82	103	101	110	86

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with that of 11. The results are given for the appropriate lengths and also for 85 percent and 115 percent of this, and the basis for these figures is 100 percent for a length to depth ratio of 11 in each instance. In the cases of the vessels with altered breadths, the percentages are based on the increased breadth in the short vessels and the normal breadths in the long ones.

It would appear that extreme proportions could not be justified for vessels on voyages of over 2,000 nautical miles unless by restricted depth of water, and if this restriction exists it would be more profitable to increase the breadth than the length beyond normal proportions, provided, however, that such increase did not give an undue excess of stability. Fortunately, extreme proportions would generally be associated with relatively small vessels, and in such it is a comparatively simple matter to add the additional material required to provide the necessary strength. For convenience in calculation the differences have been estimated in terms of length and depth, but it will be understood that when the breadth instead of the depth can be reduced, in vessels with extreme proportions better results will be obtained.

The proportions of the *Horace S. Wilkinson* have already been alluded to, and it is realized that as this vessel is of very special type and construction it may not come within the scope of these calculations. With all the information at hand, it would appear that if the vessel were shortened to about 430 feet and the other dimensions retained, the freight rate might be reduced by about 5 percent. There may be other practical factors which prevail, however, and these remarks should therefore not be taken in a critical sense.

Why is a Progress and Planning Department?

BY DONALD G. STEVENS*

SOMETIME ago the manager of the progress and planning department of a certain eastern shipyard was asked the following questions, not only by heads of other departments with whom he was associated indirectly, but by some of the foremen with whom he was directly interested:

"What does the department stand for? We know you compile a lot of interesting data which you show on attractive charts, and we know there is a considerable amount of work attached to it, but after all what does it amount to? What does it mean to me?"

In reply to these queries the following article appeared in the minutes of the inter-departmental and foremen's meeting:

The function of the progress and planning department is to present to the management a means of control. This is brought about by showing in various ways production as compared with the plan.

This planning covers the keel laying, launching and deliveries of our ships to suit a rate of construction as outlined by the plant manager, and agreed to by the vice-president. To control the progress intelligently planned, important items are used as barometers of the whole, such as rivet drives and erection by hulls, and art shown in chart form in various offices, and on which the actual results are posted each week for the week preceding. In connection with the same thought, and handled in the same manner, are charts showing: (a) total rivet drive; (b) total erection; (c) number of rivet gangs; (d) number of rivets per gang hour and number of men working. There are also tank testing charts for each hull, which show the date the tanks are to be ready for water and when they are planned to be passed, and the dates are posted thereon when same are actually passed. By this method it is clearly shown just how the construction of our hulls compared with the plan, and any deviation is vividly shown.

For the information of the plant manager, the general superintendent and the departments affected, this department keeps up a number of daily charts which show the subdivision of the classes of labor, and are made use of with the idea of properly distributing the work and to eliminate as far possible the day work and to increase the piece work, as this will of necessity cheapen production. These charts are as follows:

(a) Rivets driven per hull per day.
(b) Rivet gangs per hull per day.
(c) Distribution of rivet gangs (whether day work, piece work or agreement).
(d) Rivets per gang hour and cost per rivet.
(e) Departmental charts for bolting, chipping and calking, drilling and reaming (which show number of gangs, day work, piece work, amount of production and cost per unit of day work, piece work and average cost).
(f) Number of night men working.

For the information of the management and all of the individual departments, and graphically shown, are forty departmental charts which show the trend of weekly expense of each department as compared with the entire yard, and which also show the average hour-day rate except when the unit cost can possibly be shown. By such a comparison it is clearly shown just where the increase or decrease occurs, and by study of each department shown it is possible to determine whether the conditions are justifiable and leading towards efficient shipbuilding.

Other miscellaneous charts which deal with our plant as a whole and which reflect our physical condition are:

(a) Weekly commitments and average to date.
(b) Monthly cost per deadweight ton.

In regard to the above work it might be added that there are 145 charts kept up by the progress department which are divided in various proportions in twelve offices (the forty departmental charts not included).

In addition to this the department makes up the following weekly reports: Productive cost report, E. F. C. rivet report, E. F. C. steel situation.

The production cost report is a summary of the week's production and costs per unit, and shows in a comparative way the progress of our yard.

Other miscellaneous work is the determining the percent complete of our hulls on the first and fifteenth of each month, and by which the cost per deadweight ton is figured; the weekly forecast of production for the plant manager, and other work of the above description.

The department is now working on a plan to arrive at a unit of production whereby the work of all departments may be compared from week to week and with one another.

* Manager of Progress and Planning Department, Virginia Shipbuilding Corporation, Alexandria, Va.

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Freeboard and Strength of Ships*

An Examination of the Existing Rules and Practices of Various Countries Regarding Freeboard and Strength of Ships—Considerations Towards the Establishment of International Rules

BY J. BRUHN, D. SC.

FROM the point of view of the safety of the passengers, crew and cargo, it is of little importance whether a ship founders for want of freeboard, stability, watertight subdivision or strength. It is therefore equally important that a ship should be in possession of a sufficient amount of each of these four qualities. From the point of view of the necessity for government control, their importance is nevertheless in a different position. In practice it has been found that ships are to a sufficient extent assured of having the required amount of stability by leaving it to the shipbuilders to produce a vessel that can be suitably loaded so as to be in possession of the necessary stability and by leaving it to the master of the vessel to see that she is properly loaded.

On the whole, this method of ensuring that ships are in possession of sufficient stability has been satisfactory, and government control has been unnecessary, which is well, as it would be exceedingly difficult to devise a method which would give greater safety than this one, where the responsibility for the stability rests entirely on those who, when the stability is needed, i. e., when the ship is at sea, can alone control the factors governing it. Statutory regulations regarding the stability of ships would also, if they were at all practicable, not be particularly needed, because stability is not a property the increase of which reduces the earning capacity of a ship.

The question of the watertight subdivision of cargo ships has been left to the classification societies and shipowners. Here an increase of safety, i. e., a shortening of the holds, goes against the owners economical interests, and government control may therefore be desirable, and it can in this instance, if found necessary, be applied without difficulty.

Why Freeboard Must Be Controlled

With regard to the question of strength, there is always a temptation for an owner of a ship to try to reduce unduly the amount of structural material in order to increase the deadweight or the earning capacity of the ship. The influence of the shipbuilder and the classification society will, as a rule, be a hindrance to an owner going too far in this respect, but apart from this the temptation to reduce unduly the strength of a ship occurs practically only once, viz., when the ship is being built, and even then in a not very acute form with an immediate economical gain in sight. It is quite otherwise with regard to the loading of a ship. An owner has here always a much greater temptation to go too far than in the case of the strength. The draft can, after the vessel is built, easily be increased for the particular voyage or from time to time as competition may indicate the desirability of such a proceeding, until the safe limit is ultimately exceeded. There is therefore much greater need of government control with the freeboard of ships than with stability, subdivision or strength.

It was only natural when a classification society (Lloyd's Register) first proposed rules for the freeboard of ships that the rules were arranged to fit in the most convenient manner the types of vessels then provided for in the society's classification rules. In that way it came about that the first complete freeboard rules prescribed a larger freeboard for certain types of ships (viz., the awning and spar deck types) than was necessary from a height of platform or spare buoyancy point of view. When the Board of Trade had first to put into force statutory load line regulations, it was also natural that the very complete freeboard rules prepared by Lloyd's Register should be adopted practically without alteration. These first government freeboard rules might, however, very well without any reduction in the general standard of safety have been so arranged that they only prescribed a real minimum freeboard or height of platform for all vessels. If in certain cases (awning and spar deck vessels) the freeboard was larger than that required by the rules, so much the better. For all ordinary types of vessel these freeboard rules left in practice the controlling of the strength to the classification societies. If, in the case of awning and spar deck vessels, the freeboard were larger than prescribed, all that was required would be an arrangement whereby the necessary strength was guaranteed, and if the controlling of the strength were left to the classification societies in the case of all ordinary vessels with the minimum freeboard, there appears to be no good reason why the same control should not also be left to these societies in the case of awning and spar deck vessels, where the only difference between them and the former vessels was that the freeboard was somewhat larger. In other words, there appears to have been no particular necessity for the government to lay down special regulations for the determination of the freeboard of classed spar and awning deck vessels.

The principle of practically leaving the control of the strength of ships to the classification societies in the case of all vessels having the minimum freeboard permitted by the load line regulations and of having certain government regulations for the strength of vessels with larger freeboard has been incorporated from the British rules into the freeboard rules of all other countries, mainly, of course, because the British rules were the older ones and they have therefore served as the pattern for the others, but to a certain extent no doubt also because the various national classification societies, which administer the rules found such an arrangement convenient, as these institutions would otherwise be compelled to have a similar arrangement of their own for dealing with the vessels having a larger freeboard than the minimum permitted by the government rules, just as Lloyd's Register had before there were Board of Trade freeboard rules. The principle is nevertheless not a very rational one. The original idea in Lloyd's Register freeboard rules was that the extent of loading of the various types of vessels such as flush deckers, spar deckers and awning deckers should be in proportion to the strength of their hulls. This idea was, of course, sound enough and could be carried out

* Paper read before the Institution of Naval Architects, London, March 25, 1920.

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satisfactorily in practice as long as the assigning body used the same standard of strength for all three types of vessels. The Board of Trade standard (Lloyd's rules of 1885) stood practically unchanged for thirty-five years. During this time experience showed the necessity of making many alterations and additions to the classification rules. The consequence of this has been that the latter rules in many cases call for greater strength than the Board of Trade rules. The classification society's rules were applied to all ordinary full scantling types of vessels (flush deckers, three island vessels, etc.). If these rules had been applied consistently in the same manner to the other types (spar and awning deck vessels), then the original idea that the loading should for all types be in proportion to the strength could have been carried through. It became, however, the practice of the assigning bodies to deal with spar and awning deck vessels (or practically all vessels classed "with freeboard") on the lower Board of Trade strength basis. The result was that the additions which the classification societies in the course of time had made to the scantlings of these vessels to a large extent became illusory as the draft could, in accordance with the government regulations, be increased correspondingly. The standard of strength of these vessels was thus in reality lower than that of the ordinary types of vessels, in the proportion in which the requirements of the 1885 rules were below those of the present rules.

One consequence of this anomaly is the well-known fact that a shelter deck vessel can, according to the Board of Trade regulations, when the tonnage opening is closed, suddenly be immersed two or three feet deeper in the water without any increase of the scantlings, because when there is a tonnage opening such a vessel is dealt with on the basis of the regular classification rules, and when there is no tonnage opening she is dealt with on the lower Board of Trade standard.

> The main object of government regulations regarding the strength of ships in connection with the assignment of freeboard ought to be to provide an adequate margin of safety for passengers and crew. This object can hardly be achieved by the regulation proposed by the load line committee. It may, nevertheless, be that the proposal is the best possible for British conditions, taking every circumstance into consideration, but the conditions are different in other countries. My object in reading this paper has been to raise, if possible, a discussion on the subject where the voices from other countries can be heard before a method of dealing with the strength of ships could be established internationally, and I hope my friends on the British load line committee will not take offense at my criticism of this particular point in their report.—*J. Bruhn, D. Sc.*

FREEBOARD RULES ADAPTABLE FOR INTERNATIONAL USE

Freeboard rules in the narrow sense of the term are of the kind which it is particularly desirable should be uniform in all countries, so as to ensure a uniform standard of safety and a fair international basis for competition with regard to carrying capacity, and freeboard rules are at the same time of a nature which makes them comparatively easily adaptable for international use. It is otherwise, however, with the question of strength. An international application of strength regulations is not nearly so necessary as an application of pure load line regulations, and it is not nearly so easy, at least until universal classification rules may be adopted. The proposal of the British load line committee of 1915 is, as regards the rules for the minimum freeboards of vessels, probably the best that could be made as a basis for an international agreement on this point. On the question of the relation of freeboard to strength, the committee seems on the other hand to have been afraid to deviate too much from the established order of things. However much the system may be improved, if a second standard of strength, which must necessarily be a lighter one, is introduced in addition to the classification standard, there will still be anomalies. The committee's proposed method of dealing with the strength question cannot, therefore, in spite of the many improvements in details (as compared with the earlier method), be considered as a very satisfactory one, particularly if it is to be used internationally. There appears in reality to be no very strong reason why detailed regulations regarding the question of strength should not be left out of international freeboard rules. Such regulations cannot under any circumstances provide a guarantee of the safety of a ship in every respect. They ought, and practically can, only provide a statutory security against one particular danger, viz., undue overloading. The question of stability of the vessel is, for instance, necessarily left entirely to the care of the master, and when, from the point of view of safety, so important a property as the stability of the vessel can be left out of consideration in assigning the load line, it would appear that the strength of the vessel might with equal safety be left out of consideration in this connection.

It may, however, be expedient to make some reference in international freeboard rules to the question of strength, as it is no doubt expedient to make some reference to the question of stability such as that proposed by the British load line committee. In the first place it might be made clear that the freeboards prescribed are the absolute minima. Secondly, it might be stated that all vessels allowed to load to these freeboards are to have at least the scantlings required by a recognized classification society. A requirement of this nature would, as regards its results, be in accordance with the present practice in all countries having load line regulations. Thirdly, there might be a regulation to the effect that the standard of strength for all vessels with a higher freeboard than the minimum laid down in the rules shall not be less than that required by the particular assigning society for vessels of the full scantling type. In that way each classification society would have only one minimum standard of strength for all first-class seagoing vessels, and the society itself would be entirely responsible for the upholding of this standard, both for the full scantling types and for the lighter scantling types, whereas by the present practice the classification society is really only responsible for the strength of the full scantling vessels, the strength of the vessels with reduced scantlings being regulated not entirely by the society's own rules, but more or less by the legal load line regulations.

It is very desirable that the strength required for any given draft or freeboard should be clearly laid down. The British load line committee proposes that there shall be provided freeboards for two types of vessels, the flush deck one and the complete structure one. This principle is a very convenient one, and it will no doubt be adopted internationally. In Norway such a practice has, as a matter of fact, been used for a long time. Probably all

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classification societies have already got rules for the scantlings of these two types of ships. All that is necessary in order to obtain a regulation ensuring a uniform application of strength requirements for each society would therefore be a statement to the effect that the scantlings for vessels with freeboards falling between that of a flush deck vessel and that of a superstructure vessel are to be obtained by direct interpolation between the scantlings required for the flush deck vessel and the scantlings required for the superstructure vessel. Let S

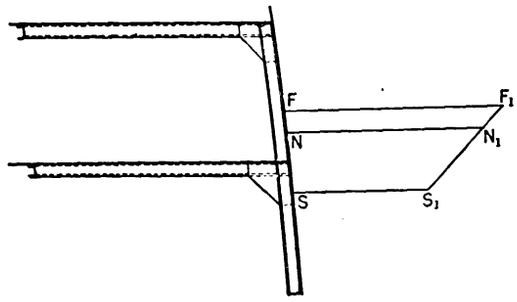

Fig. 1.

and F (Fig. 1) be the respective positions of the load lines for a superstructure and a flush deck vessel and let SS_1 and FF_1 represent the dimensions or numbers which the classification society in question use for the determination of the scantlings of the superstructure and flush deck vessel respectively. For any intermediate position of the load line, say N, the dimension or number regulating the scantlings will then be NN_1. The scantling requirements under such a regulation will therefore be as completely specified for a vessel with an intermediate freeboard as they are for the two standard types, and some such method will probably be necessary if the original idea of uniform strength in proportion to draft is to be carried out in a satisfactory manner in practice. In Norway such a procedure has been established for some time.

British Load Line Committee's Strength Proposals

The method proposed by the British load line committee of dealing with the strength question involves in reality a fixed standard of strength apart from the current classification regulations. It is in this respect no better than the previous method based on the strength standard of 1885. From the manner in which it is arrived at, viz., as a sort of minimum of the minima of the classification requirements, it follows that the standard will, like the previous one, be below the current practice. A vessel may therefore under the proposed method be built with the classification scantlings required for a certain lighter draft and may then, just as under the present regulations, claim to be allowed to load to a deeper draft, viz., that which the proposed government freeboard standard of strength would allow. It may, of course, from a narrow classification society point of view be considered satisfactory to have such an officially recognized standard of strength lying below the classification standard, as it will to a large extent relieve the classification societies of the full responsibility for the strength of the ships they class. In the long run, however, it is better for the classification societies, as well as for all other interested parties, that these institutions should alone have the full responsibility for the sufficiency of the scantlings they prescribe. In time the proposed system might have the effect of pressing the various classification requirements down to a standard for which no one would really have any direct responsibility, a state of affairs which would also be unsatisfactory.

The method which the load line committee recommends for the determination of the required scantlings may be considered quite satisfactory as a naval architect's method of examining many questions regarding the strength of ships. I have myself in two papers read before the Institution of Engineers and Shipbuilders in Scotland in 1902 and 1905 recommended very similar methods for such purposes of comparison. The method is, however, not satisfactory when it is a question of establishing a fixed legal standard of strength, particularly an international one. It is quite clear that such a method cannot take account of all the factors affecting the correct and complete determination of the minimum strength required. It cannot therefore be scientifically right and it would be exceedingly undesirable to fix a method of this kind in a rigid legal form which could not be altered for a long term of years to rectify the faults which would be sure to be discovered in course of time in the same manner as faults have been discovered in the previous load line regulations and as faults are discovered even in the best of classification society's rules. It is quite impossible with such systems to foresee all the conditions which may affect the problem. If a method such as the one proposed by the load line committee were established internationally it would soon be looked upon as a scientifically correct way of estimating the strength of ships, and as it would become unalterable, like the laws of the Medes and Persians, it would come to be a hindrance to progress towards using more correct methods.

Objections to Proposed Methods

From a scientific point of view there may even now be raised several objections in details against the proposed method. It assumes that the moment of resistance principle is sufficiently free from faults to stand as the main basis for strength estimates. This principle is, however, far from correct for so complex a girder as that of a ship's hull, and in the manner in which it is proposed to be applied it ignores, among other things, the component effect of the local straining actions in the same or another plane than the main one. The important bending and buckling tendency of the deck and bottom plating is thus ignored. In determining the moment of resistance for longitudinal strength, the form of the midship section is ignored, with the result that a ship with a high rise of floor would be required to have even thicker plating than one with a flat bottom, which would not be in accordance with the lessons of experience. Two very important factors are also ignored, viz., the nature of the trade the vessel is engaged in and the distribution of weights. At present, classification societies also ignore these factors, but they ought to be taken into account as time and progress make it possible to do so. The Norwegian classsification society and the Norwegian Board of Trade have, as a matter of fact, to a certain extent already taken these factors into consideration. In estimating the transverse strength, the plating is ignored in the determination of the moment of resistance of the frames. This will give very misleading results as to the comparative values of the various forms of frame sections. Channel bars or frames with very heavy reversed bars would thus appear too to be strong compared with bulb angle frames. A number of other more or less important factors are ignored in dealing with the transverse strength, such as the effect of the vessel's breadth, spring, bulkheads, stiffness of bottom and deck construction, the form of the vessel (curvature of frame), effect of size of lower deck beam knees, etc. The stiffness of the ship (metacentric height) is also an important factor when it is a question of de-

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termining the proper minimum transverse strength of ships. It does not figure directly in the classification societies' rules for the determination of the scantlings of frames, floors, etc., but it is indirectly there to a certain extent, as the scantlings prescribed for sailing vessels without bulkheads, for instance, very distinctly assure that the stiffness deviates but little from the normal for such vessels, otherwise the strength would in many cases be quite insufficient. There is in the load line committee's proposal no standard of strength at all for the deck (beams) and bottom (floors) of ships, although both these parts are very important—in fact, just as important as the sides of the vessel and, as far as the bottom is concerned, just as closely related to the draft or freeboard of the vessel. The above points are sufficient to show that the proposed system is not scientifically quite satisfactory.

PROPOSED METHOD INCOMPLETE

There are also, from a practical point of view, objections to the proposed method of dealing with the question of strength. In reality this method means the establishing of a second system in addition to the classification society systems of determining the scantlings of ships. It is clear that the required scantlings could for the items in question very well be produced by some such method as the one proposed, just as satisfactory scantlings might, owing to the great similarity in the proportions of ships, be produced by many other methods than those adopted by the various classification societies. The question is, therefore, whether the new system is necessary or is a better one than the old one.

It might, from the point of view of public safety, be necessary to introduce a new method, if the previous one did not provide sufficient strength. But the proposed system being a minimum of the present minima leads to less strength than is now required. There can therefore, from the point of view of safety, be no necessity for it. Moreover, if the proposed system were required from the point of view of safety, it ought to be reasonably complete and provide the required strength for all those parts the weakness of which might affect the safety of the ship, in the same manner as the present classification methods do. It is, however, by no means complete. There is thus, as already pointed out, no provision at all for the strength of the bottom or decks nor for the strength longitudinally and transversely at the ends of the vessel. If a ship breaks down for want of strength in the bottom or at the ends, the consequence will of course be very much the same as when she breaks down for the want of longitudinal strength amidships. Again, there is no provision as to what rivet attachment is required for the various parts of a vessel. Experience shows that with the present practice it is usually in the rivet attachments that weakness occurs, and it would therefore, from the point of view of safety, be particularly desirable that a minimum safe basis for the amount of riveting required should be provided. The load line committee does not mention either what is to be done with wood and composite ships, which is particularly regrettable seeing that many ships of this type have lately been built and these would also be in need of strength. Nor are old ships provided for. It may be argued that all these points will be looked after by the assigning bodies, and that, no doubt, is so. In practice all these points must of necessity be looked after by these bodies, and, moreover, the probability is that the same bodies will look after the strength in their own way, even where the proposed load line regulations prescribe scantlings. In fact, the classification societies' requirements would be absolutely necessary in addition to the proposed method, but then the latter could not be a better or even a satisfactory method.

As the classification societies' methods are the more complete, the proposed one would, in fact, be unnecessary. The introduction of another system in addition to the classification societies' system would mean that there would be two systems for the determination of the same thing, viz., the proper scantlings of ships, and this would further mean that shipbuilders and designers would have to work out the scantlings of ships according to both systems, which would involve an unnecessary waste of time. It might be that the classification societies would attempt to draw up their regulations in such a way that their scantlings always came out in excess of those required by the legal regulations. In that case shipbuilders and designers could, when using the classification regulations, be sure that they were on the right side. But the other regulations would then serve no practical purpose.

From the practical application point of view, the proposed principle of only requiring certain moments of resistance and not specifying definite scantlings is unsatisfactory and will, particularly if it should be applied to international practice, cause many questions to be raised as to which form of frame section, thickness of web, width of flanges, etc., should be required.

From the way in which the formulæ proposed by the load line committee are arrived at, they must, as stated above, necessarily lead to insufficient strength. An examination of the scantlings which would be satisfactory according to the proposed method will confirm this. A comparison with the scantlings which experience has shown to be necessary for the trades of Norwegian ships proves also that the proposed strength is, at least in this case, insufficient, and it would therefore be quite indefensible to adopt the proposed standard of strength as the legal standard for Norwegian ships.

DRAFT AS A FACTOR IN DETERMINING SCANTLINGS

Most classification societies have up to the present based their scantling requirements for ordinary ships on the dimensions of the vessel and have ignored the draft in this connection. This is convenient, as the draft is a less definite quantity than, for instance, the depth of a vessel. There is, however, in principle no reason why the draft should not enter into the determination of the scantlings, but it would be most rational that it should do so by being incorporated directly into the particular system used by the assigning body in question, otherwise anomalies cannot be avoided. An example of how such an incorporation may be effected was shown above.

CORRECTIONS.—On page 271 of the April issue was shown an illustration of the 100-foot harbor tug *Energy*, which it was stated was built by the Northwest Engineering Works. Although the Northwest Engineering Works built several vessels of this size and type, this particular tug was built by the Leatham & Smith Towing and Wrecking Company, Sturgeon Bay, Wis., and the engines were built by the Marine Iron Works, Chicago.

On page 362 of the April issue in an article on "Standardizing Tackle Blocks," a typograpical error occured in printing the following equation:

$$p = \frac{Q}{Z' \times d} = \frac{14{,}000}{4\frac{7}{8} \times 1\frac{1}{2}} = 7{,}920 \text{ pounds per square inch.}$$

The correct result should read 1,920 pounds per square inch.

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The Economic Position of Great Britain as a Shipbuilding Country*

BY SIR ALFRED YARROW, BART.

EVERYONE is asking: "How long will the present shipbuilding boom last, and what will be the situation when it ends?" The answer is: It will last as long as the following two conditions hold: (a) That the world's carrying trade in passengers and cargo needs more tonnage to carry it. (b) That we can supply this tonnage at least as cheaply as our foreign competitors. The first of these two conditions is closely related to the financial and commercial standing of our own and other nations. The second depends upon our general economic position, and especially on the efficiency of our shipbuilding and allied industries.

As shipbuilding and, in fact, all our industries depend in a great measure upon the financial stability of the country, let us consider the country's present liability and how best to meet it. The country's liability is shown in Tables I and II.

TABLE I.—ESTIMATED NATIONAL EXPENDITURE IN 1919-20

National debt services	£360,000,000
Payments to local taxation accounts, etc.	9,763,000
Land settlement	5,000,000
Other consolidated fund services	1,832,000
Army	287,000,000
Navy	149,200,000
Air force	66,500,000
Civil services—	
Public education	38,841,000
Old age pensions	17,892,000
Ministry of Pensions	72,855,000
Insurance, etc.	13,435,000
Civil demobilization and resettlement	30,874,000
Loans to Dominions and Allies	87,500,000
Railway agreements	60,000,000
Bread Subsidy	50,000,000
Other civil services	74,407,000
Add: supplementary estimates to be presented	60,000,000
Customs and excise and inland revenue departments	8,537,000
Post office services	41,274,000
Total	£1,434,910,000

TABLE II.—PRESENT ANNUAL EXPENDITURE

Treasury estimate of the national expenditure for the year 1919-20		£1,434,910,000
To this total we have to add the value of what we import in excess of what we export, the difference being what we owe to the various countries from which our imports come. According to the Board of Trade returns for last year this amounts to	£669,000,000	
From this we are entitled to deduct what are called "Invisible Exports," but which would be better termed "estimated revenue made abroad by British owners and by British shipping and remitted to this country," which is estimated at	520,000,000	
Leaving a balance against this country of		149,000,000
Sinking fund		36,000,000
Grand total estimated expenditure		£1,619,910,000
Estimated revenue, 1919-20		£1,168,650,000
Annual present increase of our indebtedness		£451,260,000
Assuming emigration to foreign countries (excluding our colonies) continues at the same rate as before the war, there will be an annual drain on the country to cover the cost of bringing up those emigrants, estimated at	£40,000,000	
We are still further in debt to the extent of the paper currency issued in excess of the gold in hand, which is approximately	£300,000,000	

To endeavor to arrive at the turning point when our revenue will be equal to our expenditure, it is clearly evident we must reduce all expenses such as naval and military expenditure (estimated by the treasury at £1,434,910,000), which is mainly in the hands of the government; but it rests also with everyone to work hard and to make our exports equal our imports and thus endeavor to blot out the £669,000,000 representing what we are annually purchasing from abroad in excess of what we are sending in part payment, and if possible, ultimately, as in the United States and in many countries, to export more than we import. Unless we supply sufficient manufactured goods to the markets of the world in payment of what we need from abroad, foreigners will decline to supply us with foodstuffs and raw material, or will only do so at very high prices, which will lead to scarcity and to even still higher prices. This is what is taking place at the present time.

The only way to secure for the artisan continuous employment at good wages is for every man to do his best and be paid in proportion to his efficiency, and in this supposed free country we should insist that everyone shall be free to work when and as he chooses. Any method of artificially increasing wages only results in a temporary gain at the sacrifice of the worker's future welfare.

It is a fact that generally where wages are high and the output per man is also high, the cost of production is the lowest, and, in consequence, trade is secured. The reason why high wages, and output in proportion, are advantageous, is that the establishment charges are thus diminished proportionately to output.

If regulations are made restraining our artisans from doing their very best, by insisting on arbitrary lines of demarcation or by reducing output, this increases the cost of production so that the lead in shipbuilding will pass into other hands and a very heavy responsibility will rest upon those who make such regulations.

Competition

The following statistics illustrate the rapid advance in shipbuilding made by the United States and Japan in recent years. Unless we are able to build as cheaply as in these countries, the time will inevitably come when British and foreign shipowners will purchase their ships from foreign builders in the same way that marine engineers in this country prior to the war obtained their shaftings and forgings from Germany.

MERCHANT VESSELS LAUNCHED (IN TONS)

	1913	1919
United Kingdom	1,932,000	1,620,000
United States	276,000	4,075,000
Japan	65,000	612,000

TABLE III.—PRODUCTION OF MILD STEEL (IN TONS)

Year	Great Britain	Germany and Luxemburg
1873	588,000	310,000
1883	2,041,000	859,000
1893	2,983,000	2,231,000
1903	5,113,000	8,669,000
1913	7,663,000	18,958,000

This table illustrates the advance in the production of steel in Great Britain and in Germany from 1873 to 1913, i. e., forty years, and shows how far we were left behind in an industry in which we formerly held the first place. In the same way, our new competitors in shipbuilding will most certainly leave us behind unless we exert ourselves far more than we are doing; our shipbuilding industry will suffer and unemployment will follow.

* From a paper read before the Institution of Naval Architects, London, March 25, 1920.

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To throw some light upon the cause for this rapid advance in Germany as compared with this country, I beg reference to the report of the Iron and Steel Institute, which states that in 1913 the weight of steel made per shift was approximately in the ratio of: English, 1; American, 1.5; German, 2—that is to say, the output per head in Germany was twice that of England.

I should like to say a word about the £40,000,000 put down as the cost to this country of emigration. People often speak of emigration as "a blessing, finding employment for the surplus population." To feed, clothe and educate from infancy those who ultimately emigrate to foreign countries is a clear expense to us. Assuming, in round figures, that 100,000 leave us annually to go to foreign countries (excluding the colonies), and assuming that an emigrant costs £400 to bring up, we are actually incurring an annual expenditure of £40,000,000 per annum for the benefit of other countries, and in some cases raising up future competitors. For example, in the United States we find that at least one-half of the shipyards are controlled by men from the Clyde and the Tyne.

In the United States and Germany, before the war, industries were developed with such rapidity that employment was found for even a greater number of people than the natural increase of the population, and immigration took place on a considerable scale into the United States and into Germany, while in this country our industries and trade did not keep pace with the increase of the population, and emigration was the result. Emigration from a country is an indication that industries are not being developed there at the same rate as the increase of population, while immigration indicates the reverse.

The only way to reduce the £40,000,000 sterling per annum drain on this country due to emigration is to do our utmost to increase our trade, so that people may find here profitable employment, which is dependent, as in the United States and Germany, upon developing our industries. Not only must we seek to produce cheaply, so as to secure trade, but we must not neglect the encouragement of science and research, because our prestige as a shipbuilding country depends not only upon building ships cheaply, but also upon our keeping well to the front in improvements. Following the example of the United States and Germany, an attempt is now being made by the government to encourage the application of scientific research to industries, and there can be no doubt that it would benefit the shipbuilding industry if more scientific men were introduced into private establishments. Evidence of this deficiency is proved by the tardy appreciation by many firms of the advantages to be secured by investigations carried out at the experimental tank at Teddington.

I venture to think that nothing will be seriously accomplished to remedy this deficiency until science is more generally taught in our schools, and to ensure this a greater number of the head masters must be drawn from men trained in science rather than from those trained in classics. To show the remarkable position as to the scientific attainments of the head masters of the seventy-three public schools in England, the degrees they have taken in various subjects, according to the British Association report on science teaching in 1917, were as follows:

Literary and classical	61
Mathematical	9
Science	3
	73

There is no doubt that to develop our industries, including shipbuilding, the head masters, while upholding the old traditions, which have been so successful in the past and have made the British Empire what it is, must advance with the times; and in an age when science is a necessity for the development of our trade, more attention must be given to scientific training in all schools, so that everyone, including our political leaders, may at least be conversant with the importance of science, in which they have been seriously deficient in the past.

I have tried to show how much financial and economic considerations have to do with our shipbuilding future. Put briefly, our shipbuilding industry depends:

1. Upon our shipbuilders being able to produce ships cheaper than our competitors, and shipowners being able to order ships from us instead of from abroad.

2. Upon our keeping well to the front in naval architecture, which is greatly dependent upon scientific research.

3. Upon our having in view that among our present competitors are the United States and Japan (and, later on, Germany), where the most up-to-date equipment is to be found in their shipyards and engine works. We must therefore adopt the most modern machines, and where old ones exist, which are costly to work, take Lord Fisher's advice and "scrap the lot."

Further, I think many firms might take more interest in the welfare of those in their employ, and by extending more human sympathy towards them in their daily business life inspire mutual confidence. This, I believe, is mainly to be obtained by personal intercourse between employers and employed, and it rests with the former to secure this end.

I would once more call attention to the heavy responsibility that rests upon those who make restrictions on labor which restrain our artisans from doing their very best, by insisting on arbitrary lines of demarcation or by reducing output or by preventing those who can and are anxious to work—both men and women—from so doing and thus render it impossible in the future for our shipbuilders to meet foreign competition.

In face of these facts for anyone to imagine that by limiting output we are adding to our prosperity is inconceivable. This view, I feel sure, is not shared by the better-informed British workingman, for the vast majority are men of intelligence, and when they come to a full realization that slackness will not only imperil the nation but will injure their fellow-workers, they will, I feel certain, respond to the demands made upon them.

Improved Method of Installing Ship Windows

A NUMBER of ships built in the Harlan plant, Wilmington, Del., of the Bethlehem Shipbuilding Corporation, Ltd., have had a special type window installed which was invented by John S. White, superintendent joiner at this plant. This window is intended to provide a number of alternative sashes or closures and means for adjusting these without employing the customary canvas pocket in the sill. With the variety of sashes available, which include a blind or shutter, a storm sash, an insect screen and an ordinary sash, it is possible for the occupant of a cabin to control the light, ventilation, protection against insects and privacy as desired. A watertight sill is provided, and also a compartment above the window opening for stowing certain of the sashes when not in use.

In overcoming the undesirable features ordinarily encountered in ship window installations, the first problem was to get sufficient height above the window opening for sash stowage. To accomplish this, the house plate was made in two parts, which permitted the members to

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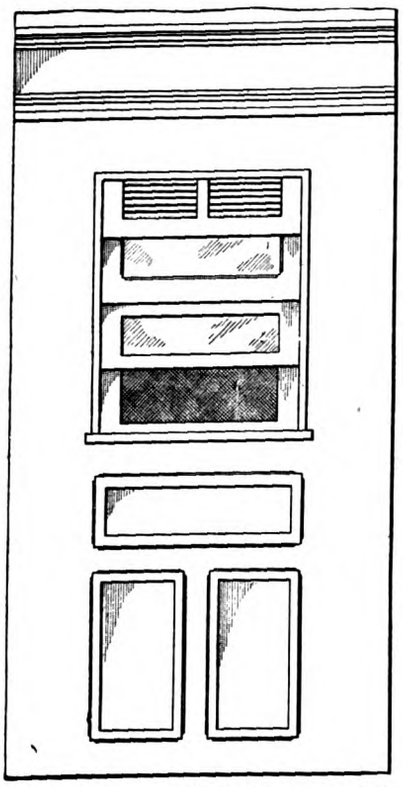
stow immediately up against the under side of the overhead deck carlins, and then a small fixed storm sash, glazed with opaque glass, was installed in the upper exterior portion of the opening. This arrangement made the inner aperture higher than the outer, which in turn reduced the height and weight of the sash, blind and the larger members of the storm sash to such an extent that they could be stored overhead without the aid of spring tape balances or counterweights.



Improved Type of Ship's Window Fitted with Alternative Sashes

A desirable feature of the arrangement has been the introduction of the storm shutter or sash in such a manner that it can be operated by the occupant of the room as readily as the sash, blind or screen. The storm sash, by having two rectangular lights of heavy plate glass, one above and one below, permits vision in either a standing or a sitting position, and when stowed overhead, the lower glass registers with the glass of the small fixed storm sash. The light is thus permitted to enter the cabin at all times without sacrificing the privacy of the occupant.

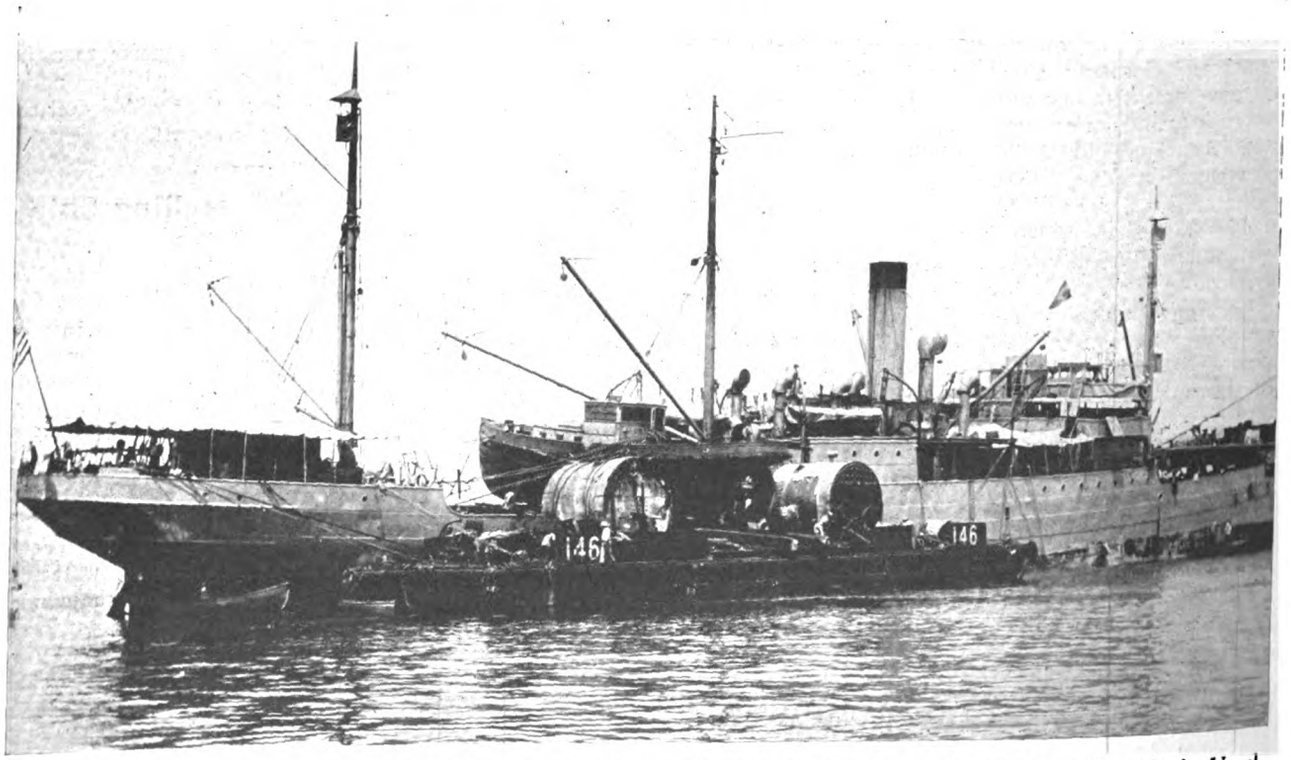
To prevent the sash, the blind and the storm sash from sticking in periods of extreme moisture, the customary wood parting bead is replaced by a channel section of composition, in combination with small strips of sheet brass secured to both the inner and outer edges of the stiles. The face side of the channel section is punched with a series of diagonal slots at short intervals, and these, in combination with the spring-operated pin of the sash lock, throw the whole weight of the members against the edge of the metal parting bead. This produces an excellent anti-rattler and affords a means for locking the sashes in any desired position. Finally the insect shutter is so arranged (as the outside sash and operated from the inside by means of a spring plunger bolt) that when the remaining sashes are stowed overhead it is possible to use the windows as a means of escape in case of accident or fire.

The installation recommends itself to consideration, for it apparently has overcome many of the difficulties of the ordinary ship window.

Launching a 45-Ton Motor Tug from the Deck of a Transport

BY LIEUTENANT-COMMANDER H. A. ARNOLD, U. S. N. R. F.

THE accompanying photographs, taken at the Cavite, P. I., Naval Station show the preparations for launching a forty-five-ton motor tug, which was brought from the Mare Island Navy Yard on the deck of the naval transport *Pensacola*. By means of a floating crane at the Mare Island Navy Yard, this tug was placed on the after-well deck of the transport, on a cradle built up of twelve by twelve timbers and braced with the same. The voyage from Mare Island to Cavite was made without any trouble.



Motor Tug Ready for Launching from Deck of Transport. Launching Ways Laid Across Coal Barge Moored Alongside the Vessel

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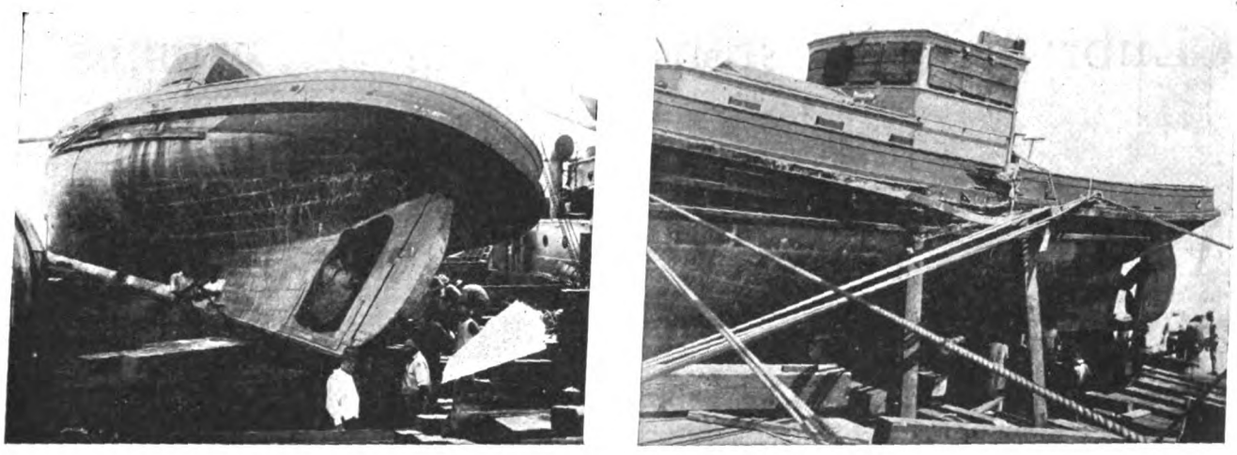
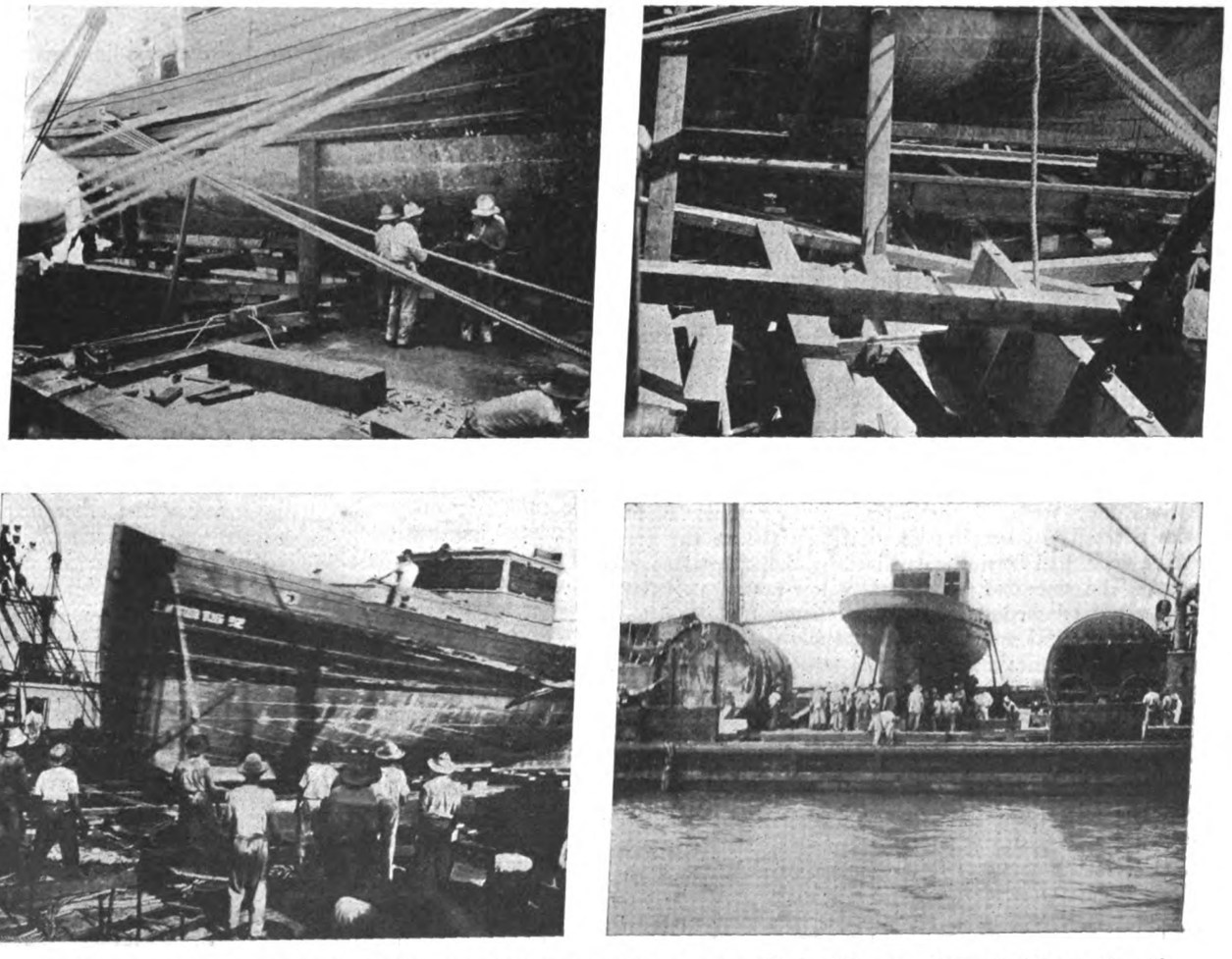


Views Showing Damage Sustained by Motor Tug in First Attempt at Launching

Upon arrival in Cavite the only shear leg which could lift fifty tons was the shear leg derrick, which was borrowed from the Army and taken alongside the *Pensacola*. The motor tug was slung with rope slings and made ready for lifting. The Army shear leg picked the tug up about four feet clear from the cradle, and without any notice or signs of weakening carried away, the tug landing part on the cradle and part on the ship's rail. The block from the shear leg went through the deck house of the tug, and the guard rail and keel were both slightly damaged.

The big job now at hand was to turn the tug around and build launching ways to float the tug. This job was done by taking a coal barge alongside the *Pensacola* and building ways from the ship to the outboard side of the barge. This work was done in five working days, and on October 1, 1919, the motor tug was launched without any trouble and is now in commission at the Cavite Naval Station.



Snapshots of Tug Showing Successful Method of Launching by Means of Ways Laid from Deck of Transport Across Coal Barge Alongside

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Lubricating System for Geared Turbines*

Standard Oiling System Developed by the Emergency Fleet Corporation for Adoption on Vessels Equipped with Geared Turbines

BY J. EMILE SCHMELTZER AND B. G. FERNALD

As operating troubles with geared propelling turbines were already being reported to an extent considered abnormal, and as many of these troubles were being attributed to faulty operation or failure of the lubricating oil system (in most instances the oiling system was not furnished by the builder of the turbine, but by the shipbuilder), it was decided by the officials of the Emergency Fleet Corporation in the summer of 1918 to study all the oiling systems in use on American ships, and either adopt or develop a standard oiling system for use on all geared turbine vessels then under construction or to be built by the United States Shipping Board Emergency Fleet Corporation.

A very small percentage of American marine engineers had had any previous operating experience with direct-connected marine turbines, and a negligible number had ever operated double reduction geared turbines, the type with which most of the vessels under construction were equipped. This fact, together with the magnitude of the projected shipbuilding program, made it necessary to train many new engineers for marine service, and at the same time indicated the necessity of standardizing, as far as possible, the propelling equipment that they would operate. The standard oiling system was therefore primarily expected to accomplish improvement in operation rather than a reduction in construction costs.

It appeared that a standardized system would materially simplify the instruction of the new engineers. Lack of standardization, moreover, would have caused accidents and confusion, even with experienced engineers, as it was frequently necessary for engineering crews to go to sea on new vessels without first giving them time to familiarize themselves with the different piping systems on the vessels.

It was also believed necessary to incorporate into the system features designed to take care of the unusual war conditions.

Direct-Pressure System Universally Used

A preliminary study of the systems being used by the various shipbuilders disclosed the fact that, with one exception, they were of the direct-pressure type, which, from necessity of keeping all vital parts below the protective deck, had been standardized by the Navy Department. The one exception was a low-pressure gravity system not adapted to turbines requiring high pressure. The fundamental problem was to supply the bearings and gear tooth contact faces with an adequate and uninterrupted supply of clean, cool oil.

In July, 1918, a preliminary plan and description of an oiling system, modeled as above, was prepared and sent broadcast to shipbuilders, turbine builders, lubrication experts, etc., for criticism and suggestions. Much constructive criticism was received and much that was essentially a defense or justification of systems to which the critic was already committed by precedent, or in which he had some proprietary interest.

As a consequence of the criticisms, a revision of the system substantially according with the majority of the recommendations was made, and submitted again to a number of eminent marine engineers, and the final revised system adopted as a standard for vessels of the Emergency Fleet Corporation on September 16, 1918.

First Installation of the System

Late in the summer of 1918, it was decided to install the system on the S. S. *Westland,* then in Hoboken undergoing repairs. Due to the short space of time allowed, it was impossible to make the installation as complete as desired, but the necessary information as to the pumps, coolers and other equipment required was furnished to the Division of Operations, and they were installed under the direction of the representative of that division in New York. While the system as specified contains many refinements not included in the system installed on the *Westland,* the results obtained from the installation on this vessel were sufficient to assure those responsible for its design of the successful operation of the proposed system. The first vessels equipped with the entire system were delivered about the middle of January, 1919, subsequent to the signing of the armistice.

As the shipbuilding program, notwithstanding many cancellations, was far from complete, it was deemed advisable to make a further revision of the system to eliminate many features specified on account of war conditions, and also to eliminate automatic features rendered unnecessary by the increasing efficiency of the operating personnel, but retaining the essential features. This revision was issued on July 15, 1919.

Coolers

Nearly all of the oil coolers previously used were inadequate to transfer the required number of British thermal units, which amounted in a number of instances to 10 percent of the propelling turbine horsepower. This was partly due to the fact that the reduction-gear manufacturers had overrated the efficiency of their reduction gears.

As a precautionary measure, it was considered essential that an auxiliary cooler be provided so that the oil could be cooled by one cooler in the event of the other being rendered inoperative by leaky tubes or other causes. The auxiliary cooler was also used in parallel with the main cooler when operating in tropical waters, where a cooling water temperature of 84 degrees or higher obtained. The technical order specified a 20-degree drop in oil temperature, while it was realized that the cooler would not be called upon to equal this temperature drop under normal running conditions, still this size of cooler provided for a considerable drop in the efficiency of the cooler, due to the fact that the tubes would in time become covered with a deposit which would materially decrease the efficiency of the cooler as compared with a clean one.

Results obtained in operation have demonstrated that the size of cooler specified satisfies average operating conditions.

Gravity Tanks—Size and Location

During the time the designs of the new system were in the course of preparation, one manufacturer claimed that

*From a paper read before the Society of Naval Architects and Marine Engineers, New York, November, 1919.

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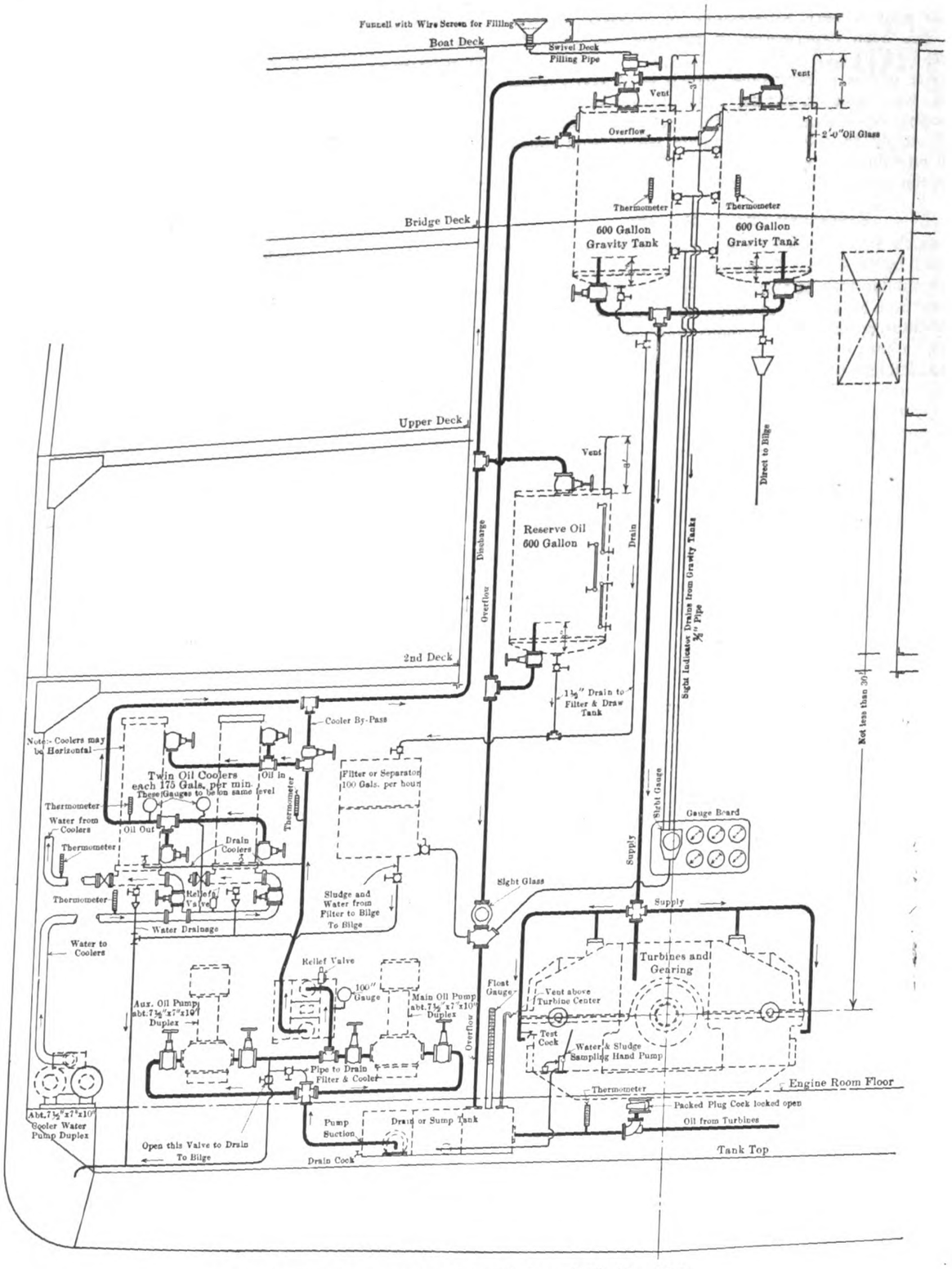

Lubricating-Oil System as Installed with Geared Turbine Unit

it was necessary to have 12 pounds oil pressure on the turbine bearings and gear oiling devices on equipment manufactured by them, and still another used spray nozzles of such size as to make it almost impossible to maintain a higher pressure than 4 or 5 pounds. The rest of the builders' requirements averaged about 10 pounds pressure at the oil manifold.

Due to the above facts, and based on the assumption that it was best to satisfy the higher pressure requirements, and also owing to the fact that all of the vessels on which installation of the system was contemplated would permit of the location, it was specified that the gravity tanks be located at a height of 30 feet above centerline of turbine in the engine room casing. This location of the gravity

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tank has proved very satisfactory in service, and no trouble has been experienced in securing the required pressure.

The size of the gravity tank, which is of 600 gallons capacity, was based on having three or four minutes reserve supply of oil available for the gears in the event of the oil supply to the gravity tanks being interrupted. This, it was thought, would provide sufficient time for action on the part of the operating personnel.

Kingsbury Thrust Bearing

Inasmuch as, on most of the various types of turbines purchased by the United States Shipping Board, the Kingsbury or similar type of thrust bearing is used, it is essential that there be a constant supply of cool, clean oil. Failure or interruption of the supply has caused the thrust bearing to burn out on several occasions, with consequent serious damage to the turbine.

This same type of thrust bearing was employed in the majority of cases for the main propelling shaft thrust, and therefore the same necessity for cool, clean oil obtained in this case.

Strainers

As a precautionary measure against sabotage, a twin suction strainer having a coarse mesh strainer basket was installed, but eventually omitted in the revised specifications at the end of the war.

A strainer having approximately 1/64-inch mesh was placed in the discharge line, and this is considered sufficient to remove all sediment incidental to ordinary operation after the system has been thoroughly cleaned before the trial trip as specified.

Filters and Separators

While all of the filters and separators specified are satisfactory for the purpose, it is considered that the results obtained from the centrifugal type of separator show greater efficiency, inasmuch as the oil, water and sediment are separated—the oil flowing from one nozzle, the water from another, the overflow mixture from another, and the sediment remaining in the bowl, from which it may be removed at will. Tests made at Annapolis prove that the rolling or pitching of a vessel will have no ill effects on its successful operation.

Filtering elements placed in gravity tanks or in the discharge line from pumps to gravity tanks at its connection to gravity tank, unless at sufficient height above, cannot function properly, due to the lack of sufficient head, which results in the oil following the path of least resistance, *i. e.*, through the overflow and not through the straining elements as intended.

Alarm Systems

An electric alarm system actuated by a float switch connected to the gravity tanks was provided (and since omitted), which would notify the chief engineer in his room and the engineer officer on watch, by means of an electric gong, that the oil level had dropped below normal operating level. This system, which was so designed as to not only give the necessary notification in case of oil level becoming low, but also to automatically increase the speed of the pumps, was later omitted, due to a desire to reduce the cost of the installation rather than because of any belief in a lack of necessity for it.

Drain Tank

The capacity of the oil-drain tank was required to be from 800 to 1,000 gallons for a 3,000 horsepower double-reduction gear turbine unit.

It was found that most of the drain tanks supplied at the time this system was originated were entirely too small, and resulted in the pumps becoming vapor bound. In most cases of this kind, and also where the suction lift of the pump was high, the oil became very dark in color. Oil experts who were consulted advised that the mixture of air with hot oil frequently resulted in the presence of sulphurous acid (H_2SO_3) in the oil. For this reason, the drain tanks were made sufficiently large and the pumps placed as low as possible to insure a short suction lift.

Pumps

While vertical pumps are more desirable for the purpose of securing low suction lift, it was not possible to procure them in the quantities required. Horizontal pumps were therefore used more extensively. The vertical pump is preferred to the horizontal, not only for the above good reason but also because of its taking less floor space and lending itself to better arrangement generally.

Oils

Originally an oil having a viscosity of 300 seconds (Saybolt) at 100 degrees F., was specified, but later this was changed to 500 seconds viscosity. This latter viscosity was found to suit conditions better because the high-speed bearings demand oil having a low viscosity and the gears and slow-speed bearings a high viscosity oil. Inasmuch as two separate systems could not be considered on account of their cost, and due to the fact that oils ranging from 300 to 700 viscosity at 100 degrees have practically the same viscosity at temperatures above 140 degrees, and also based on operating results, it was considered that the higher viscosity was more desirable.

Conclusions

The results obtained from the system in service have been very gratifying and show that the sizes of equipment specified were in keeping with the requirements, and it is believed that a system of lesser magnitude than that specified would endanger the successful operation of a double reduction gear turbine unit of 3,000 horsepower.

There is no doubt that an adequate lubricating oil system is essential to the successful operation of the geared turbine; and while its maintenance cost is small, the consumption of oil through leaks and other sources amounting to about half a barrel per month, the first cost of installing such a system is quite high. It is believed, however, that an increase in efficiency will be obtained in the reduction gears of the future, which will permit of a considerable reduction in the size, and consequently the cost of the lubricating oil system.

Lloyd's Quarterly Returns

THE returns compiled by Lloyd's Register of Shipping, which only take into account vessels of 100 tons and upwards, the construction of which has actually been commenced, show that there were 2,205 merchant vessels of 7,941,950 gross tons under construction in the world (excluding Germany, figures from which country are not yet available) at the close of the quarter ended March 31, 1920. Of this amount, 2,018 vessels of 7,801,450 gross tons were steamships. The leading place is accorded to the United Kingdom, where 865 merchant vessels of 3,394,425 gross tons were under construction; and the second place to the United States, where 535 vessels of 2,573,298 gross tons are recorded as under construction. In the United Kingdom there are three vessels of from 20,000 to 25,000 tons under construction.

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Present-Day Marine Engineering Equipment

What the Modern Marine Power Plant Consists of and the Type of Man Who Is to Handle It—Some Things That the Young Engineer Must Learn

BY JOHN C. MC KENZIE*

THE world war produced conditions hardly dreamed of in the trend of the natural course of events. Regardless of its effects in all lines of industry, probably no branch was more completely revolutionized in a short space of time than the shipbuilding industry. That Denver, Col., would build cargo winches for our steamers, or that Chattanooga, Tenn., would furnish anchor windlasses was altogether unbelievable. The extremes of inland facilities were used to the utmost, as the cry was "Ships, ships and more ships."

The "fabricated ship" became a fact, and its results have set the world thinking, as Hog Island products have demonstrated the integrity and substantiability of this class of ship. How well they have succeeded needs no special mention, for the records these ships hold are not surpassed by any ships built by our older-established shipyards.

It was necessary, owing to this insistent demand for ships, that propelling machinery for ships be bought wherever it could, and that auxiliary machinery be obtained in the same manner. One of the most essential requirements of a steam-propelled vessel being a boiler, it was also necessary that these be built wherever possible. This was the principal reason for the watertube boiler being extensively used in our ships. Steel plate was in great demand, and Scotch boilers built of heavy plate could not be manufactured as quickly as watertube boilers, whose drums were built of thinner plate and could be turned out by almost any boiler manufacturer, no matter where his plant was situated.

The shipbuilding programme gave all concerned the opportunity of aiding the Government in its time of need. The turbine, watertube boiler, superheater and all the latest improved types of auxiliary machinery had their innings, and never before was such a volume of modern equipment installed in a cargo steamer. As far as the present equipment being placed on board of ship is concerned, it is doubtful whether ten years would have accomplished it, and in many cases our conservative steamship operator would never have done it.

What About the Engineer?

What about the marine engineer who is running this modern power plant? The fact is he is being educated in the same manner as our recruits during the war. We had to train our present-day marine engineer. It was necessary to send the majority of engineers to a turbine school. Again, many, to use a trite expression, were "butchers, bakers and candlestick makers," and they had to go to school to learn the first principles of marine engineering, and some have not learned it yet.

Is it any wonder that we see ships deserted at sea, later to be towed into port and found seaworthy? What a sad commentary on a nation which, in its day, prided itself on its leadership on the sea, when "sail was king"!

Wireless is a wonderful invention, but to the present-day marine engineer it is the refuge in all his troubles. Rather than pride in himself as a result of bringing his vessel into port, it is much easier to call for assistance.

We do not go backwards in the progress of the world, but, for illustration, let us take the case of the accident to the *City of Paris* on March 25, 1890, when she was towed to Queenstown, Ireland, five days later with her stern practically level with the water and her bow high out of the water, reaching port in a condition that was considered remarkable in that day. Did Chief Engineer Walls abandon his ship, although her propelling machinery was totally disabled? He did not. He brought her into port, showing the ability of the engineering staff. This vessel is the present *Philadelphia,* a veteran of two wars, and at that time the fastest ocean liner.

Or, again, take the case of the *Umbria,* when she broke her thrust shaft in 1892. Did Chief Engineer Tomlinson wallow around the Atlantic in a seaway and pray that some vessel would come along and give him a tow? He did not. Instead, repairs were made and she came into port under her own steam.

It is even on record that propellers have been fitted at sea, but a comparison cannot be made today, where so many propeller blades are being broken, and the writer has failed to see any record of a blade being fitted at sea. He does see numerous instances of the vessel being towed into port.

The specific instances cited above in respective steamers are well within the memory of the middle-aged engineer, but the writer does not believe the present-day engineer takes the interest in his machinery that his predecessors did. His predecessor loved his engine, believed in it, and had pride in it, for it meant a great deal to him. What would the late Superintending Engineer Doran say if he returned to life and saw marine engineering "as it is" instead of "as it was"? He would suffer a severe jolt, I fear, to see so many disabled craft, and all because engineering has become a secondary consideration to marine engineers.

About twenty-five years ago our stationary engineers, or power plant engineers as we term them now, were considered back numbers. A marine engineer in that day could always secure a good position ashore. What are the conditions today? Our high-grade power plant engineer is a peer in his line, and in a great many instances is far superior to his brother marine engineer. Why? Because he has kept abreast of the times and advanced with the times and knows the operation of modern equipment to the last notch. He knows the cost of every operation in his plant and efficiency is his watchword. This type of engineer would make our best marine engineer, if he were to take up that line; for modern equipment would not feaze him and he would make good, as he would be equal to the task.

Watertube Boilers

Take, for instance, the watertube boiler. This boiler is not an experiment but a development. The present Babcock and Wilcox marine watertube boiler is not the design of twenty years ago. No concern stands still, for they would quickly go out of business, and the various watertube boiler manufacturers took every advantage of

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The watertube boiler is anathema to almost every marine engineer, simply because he believes what he wants to believe. He hears his elders say the watertube boiler is no good, and decides it is so, unless he does a bit of thinking for himself. Has he ever realized that the watertube boiler operates successfully in the navies of all nations? Does he know that our passenger liners are fitted with watertube boilers, and that with a little care and attention, well-designed boilers will respond by giving good results? Does he know that our fastest transports had watertube boilers, and "made good"? It simply resolves itself into this question—instead of the man mastering the equipment the equipment is mastering the man.

As far as present-day success is concerned, it is a strange fact, but very true, that our Pacific Coast engineer has had very little trouble with modern equipment. Why should that be so? The writer believes this to be the answer: Shortly before the war, the American flag was fast disappearing from the Pacific, and the marine engineer had to dig around for a job. He got any kind of experience he desired, and on that coast ran into watertube boilers. Knowing their ailments, he profited by experience, and invariably this type of engineer has kept free from watertube boiler trouble.

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Another cause of watertube boiler trouble has been due to engineers running the evaporator in an improper manner. With present-day turbine installation, 29 inches of vacuum is easily maintained—and herein lies one of the worst features of allowing watertube boilers to gain density. The turbine people demand efficiency, which is proper, and the marine engineer who is not familiar with watertube boilers gets inefficiency, both from the same source—high vacuum.

Can this be remedied so that both sides will achieve the same object? It is possible. Why not install sufficient evaporator capacity and have the vapor discharge into distillers of ample capacity, allowing the distillate to discharge into a tank, say, of 50 gallons capacity, then test the distillate before discharging same into the hot-well or reserve fresh-water tanks, as the case may be. For long voyages it would be desirable to install two evaporators, so that one could be kept in a clean condition as a reserve and interchange when necessary.

How about the testing of condensate for watertube boilers? The salinometer is too slow for accuracy. In many cases engineers have proceeded to sea without even knowing that there are proper outfits on the market for determining the exact number of grains of chlorine per gallon in the water tested. This procedure of testing the condensate and boiler water is the most essential to the satisfactory operation of watertube boilers at sea, and those engineers who have faithfully attended to this important detail have brought their vessels into port after covering 15,000- to 25,000-mile voyages without any boiler trouble.

Has the Scotch boiler been free from trouble? The repair yards could verify this question better than any other authority, as they are best qualified to speak. The Scotch boiler has ailments which will always be present, and according to our present operating conditions it would seem that the repairs will not lessen. The main difference between the two types is that the Scotch boiler will stand "salting up" to a greater degree than the watertube boiler.

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The writer has not lost faith in the marine engineer measuring up to his responsibilities, as the world is in a transitory stage, passing through a period the like of which is not within the memory of those living. This has affected all lines of work and is possibly due to the intense pitch to which all were keyed up. Now that reaction has set in, the pendulum has swung to the other extreme. Water finds its level, so in like manner we shall return to normal and will regain the spirit of pride and objective.

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Breakdowns occurred, as now, and extra watches were the rule, but it produced a school from which all have made good, and when that same school looks back they are amazed at the changes and strides made in marine engineering, both as to working conditions and quarters, and the type of engineer that has succeeded them.

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SINGLENESS of purpose has, to a certain extent, characterized the consideration at Washington this past year of the issue of a permanent American merchant marine. Members of the two houses of Congress, who are favorable to merchant marine expansion, and the practical men of the shipping and shipbuilding industries, who have been acting as their advisers, have been engrossed, to the exclusion of all else, with the problem of finding the best means to transfer to private ownership the fleet acquired by the United States Government and to make the nation's resources in vessel property serve as the nucleus of an enduring, creditable and profitable merchant marine. But for all the concentration on the main issue, it has been impossible wholly to ignore certain incidental problems that have been revealed by the sidelights that have appeared.

An influencing factor, regarding which not too much has been said in the public discussions, but of whose existence all parties to the new arrangements have been vividly conscious, is the labor problem—that is, the equation of labor in ship operation rather than of labor in the shipyards, although the latter is involved also to some extent. All our readers will recall with what positiveness it was declared prior to the war that it was impracticable for American shipowners to operate in competition with certain other nationalities, notably the Japanese, and that there was laid at the door of labor conditions the responsibility for the situation which resulted in well nigh driving the American flag from the Pacific. With all the laws that fostered the old conditions yet on the United States statute books, it is inevitable that the labor problem in its various aspects should stand potent, if not menacing, in the background at the current deliberations on the subject of the merchant marine.

One Solution for Labor Problem

That the solution, or at least one solution, for the American labor problem in the maritime industries and for the high costs of operation is to be found in the employment of vessels of maximum size was the interesting theory advanced recently to the Senate committee on commerce by Harry H. Raymond, president of the American Steamship Owners' Association, president of the Clyde Steamship Company, president of the Mallory Steamship Company, and other corporations operating on their own account between 85 and 90 ships of an aggregate of approximately 260,000 tons. Appearing at Washington as the spokesman for the American Steamship Owners' Association, whose members own upward of two and one-half million gross tons of their own steam shipping, and in addition operate about four million tons of Government-owned vessels of the Shipping Board fleet, Mr. Raymond said:

"American sea wages have always been higher than the sea wages of other and competing countries. This fact throughout our existence as a maritime nation has made it necessary for American shipowners to conduct their business with the utmost enterprise and economy, to adopt all possible labor-saving improvements and, generally speaking, to operate larger ships than their rivals in ocean commerce. The wisdom of building and using relatively large ships was discovered 100 years ago by the merchants of New York, Boston, Philadelphia and Baltimore who operated the famous lines of packet sail ships across the Atlantic Ocean.

"By the year 1840 these packet ships had reached a size upward of 1,000 tons, or considerably larger units than most of the British merchant vessels of that day—larger, in fact, than nearly all of them except the frigate-built ships of the East India Company, which monopolized the traffic between the United Kingdom and Indian ports. Later on, when the celebrated American clipper ships, the speedier sisters of the packet ships were constructed, these also were of a size above the average, many of them of 1,500 tons gross register. Still later, when American wooden ships of the medium clipper class, built in the seventies and eighties, were actively competing with British iron ships in the great grain trade around Cape Horn from California to Europe, it was the American vessels, generally speaking, that were the largest and heaviest carriers.

Relatively Large Ships Most Profitable

"These facts are worth recalling from our earlier maritime experience to emphasize the truth which all maritime men of today understand, that it is the relatively large ships which can be made most effective and most profitable by American shipowners. A steamship of 10,000 tons requires no more deck officers or engineers than a steamship of 5,000 tons, and only a few more in number of the crew. That is to say, in the larger ships, carrying a larger cargo, each officer and man renders proportionately a greater carrying service than in the smaller ships, an economic fact of the utmost significance to the nation that pays the higher per capita wages. Moreover, American trade is characteristically a trade of relatively large cargoes, and many—in fact, most—of these cargoes are carried long distances."

At one point in the discussion that followed, Mr. Raymond expressed the opinion that the difference in wage cost between American-owned and foreign-owned tonnage is probably "a decreasing factor." Making specific comparison between a British ship of 10,000 deadweight tons and an American ship of the same capacity, he figured that the difference in the cost of wages of officers and crew would probably not be in excess of $12,000 (£2,460) to $15,000 (£3,080) per annum, or 20 to 30 percent, "with a tendency to decrease if British sea wages should rise still further toward an equality with our wages." To equalize this wage cost, the solution proposed by resolution of the American Steamship Owners' Association is that 10 percent of the net earnings of American ships be granted on account of depreciation and the amount deducted as operating expenses in the tax returns.

P. A. S. Franklin, president of the International Mercantile Marine, addressing the same group of senators was less optimistic with respect to the prospect that there will be a gradual narrowing of the gap between the cost of American ship operation and foreign tonnage operation. "Your steamship companies," he said, "are at an

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"By the year 1840 these packet ships had reached a size upward of 1,000 tons, or considerably larger units than most of the British merchant vessels of that day—larger, in fact, than nearly all of them except the frigate-built ships of the East India Company, which monopolized the traffic between the United Kingdom and Indian ports. Later on, when the celebrated American clipper ships, the speedier sisters of the packet ships were constructed, these also were of a size above the average, many of them of 1,500 tons gross register. Still later, when American wooden ships of the medium clipper class, built in the seventies and eighties, were actively competing with British iron ships in the great grain trade around Cape Horn from California to Europe, it was the American vessels, generally speaking, that were the largest and heaviest carriers.

Relatively Large Ships Most Profitable

"These facts are worth recalling from our earlier maritime experience to emphasize the truth which all maritime men of today understand, that it is the relatively large ships which can be made most effective and most profitable by American shipowners. A steamship of 10,000 tons requires no more deck officers or engineers than a steamship of 5,000 tons, and only a few more in number of the crew. That is to say, in the larger ships, carrying a larger cargo, each officer and man renders proportionately a greater carrying service than in the smaller ships, an economic fact of the utmost significance to the nation that pays the higher per capita wages. Moreover, American trade is characteristically a trade of relatively large cargoes, and many—in fact, most—of these cargoes are carried long distances."

At one point in the discussion that followed, Mr. Raymond expressed the opinion that the difference in wage cost between American-owned and foreign-owned tonnage is probably "a decreasing factor." Making specific comparison between a British ship of 10,000 deadweight tons and an American ship of the same capacity, he figured that the difference in the cost of wages of officers and crew would probably not be in excess of $12,000 (£2,460) to $15,000 (£3,080) per annum, or 20 to 30 percent, "with a tendency to decrease if British sea wages should rise still further toward an equality with our wages." To equalize this wage cost, the solution proposed by resolution of the American Steamship Owners' Association is that 10 percent of the net earnings of American ships be granted on account of depreciation and the amount deducted as operating expenses in the tax returns.

P. A. S. Franklin, president of the International Mercantile Marine, addressing the same group of senators was less optimistic with respect to the prospect that there will be a gradual narrowing of the gap between the cost of American ship operation and foreign tonnage operation. "Your steamship companies," he said, "are at an

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additional expense of operation as compared to foreign shipowners and always will be from everything we can see, and unless they get some assistance from the Government they have a very slim chance of making a success of foreign trade in competition with the foreign flag steamers."

It has been represented to members of the national legislature at Washington and is a doctrine that has been accepted by many of them that the effect of the La Follette Act, which has been a thorn in the side of many an American shipowner, or prospective shipowner, will be gradually to compel foreign shipowners and operators to come up to the American standard of wages. Frank C. Munson, of the Munson Steamship Company, was closely quizzed on this point incident to a comparison he laid before the Senate committee as to the relative costs of operation of American and British ships. For the British steamer *Munardan* he gave a total payroll of $3,570 (£733) per month as compared with a monthly payroll on the American steamer *Walter D. Munson* amounting to $4,262.50 (£876).

Influence of the Seamen's Act

Answering a query as to the supposed leveling influence of the La Follette Act, Mr. Munson said that this might be true with respect to vessels with a terminus in the United States. He went on to say, however, that while a foreign ship coming into American ports regularly would gradually increase, because of the hiring of seamen in American ports at American wages, the wage outlay (this increase) would apply only to the ordinary personnel of the ship made up of seamen, firemen, coal passers, etc., and would apply only to a very limited extent, if at all, to officers who "stick by their ship." Mr. Munson figures that the wage expense is about equally divided in the aggregate between officers' pay and the wage of the crew. Not only, as he senses the situation, are the British officers to be counted upon to continue in their positions at lower pay than American officers of equivalent rank or responsibility, but he feels that the surplus of seafaring men in Great Britain, due to the fact that 9,000,000 tons of British shipping was sunk during the war, operates to induce British sailors to live up to their contracts more rigidly than do American sailors, despite the fact that American shipowners have voluntarily granted a post-war increase of $10 (2/1/8) a month to seamen and $15 (3/6/2) a month to firemen, which increases have not been matched by British ship operators. The disposition of the average member of a British crew to live up to his contract serves to perpetuate, of course, that disparity which it was prophesied that the LaFollette Act would gradually reduce, if not entirely eliminate. By signing a man for a year, the British shipowner gets firemen at $68 (14/3/4) per month as compared with $90 (18/18/0) on an American vessel, and able seamen at $63 (13/2/6) as against $85 (17/14/2).

Senator Chamberlain asked Mr. Munson whether the effect of the American seamen's law, while immediately discernible only in the influence for the elevation of the wages of foreign seamen and firemen, would not ultimately apply as well to the pay of foreign officers steaming to American ports who would behold the men under them receiving pay disproportionate to their own salaries. The answer was: "When we get to the time that the English merchant marine has absorbed the total number of excess crew and officers now available in England, then we will see a raise in wages probably of all of those men. Before that time it is going to be very difficult to raise the wages because there is an over-supply of that particular kind of labor. It will be at least four or five years before that can come about." Mr. Munson made it clear, however, that in so far as the United States is concerned, the raising of the wages of members of crews has had precisely the effect contemplated by Senator Chamberlain's logic—namely, a corresponding elevation of the pay of officers—and he pointed out that when the last readjustment was made the pay of all officers was advanced simultaneously with the wages of members of the crew.

A suggestion advanced by the head of the Munson Steamship Company that has received considerable attention at Washington was that embodied in his expression: "My feeling is that the laws should be changed in this country to permit of our absorbing as citizens British masters and British officers, of which there is a tremendous dearth in this country. We have been building ships so fast that we cannot officer them. We have been promoting men who are not capable of being officers—promoting them to be masters and chief officers—and we need those men in England who are not in demand. If we can bring them into American vessels we would fill the greatest need that we have in America today. We want American citizens running American vessels, but we want a chief engineer who knows his cargo and can fit her in shape. We do not want a chief engineer promoted from oiler who really does not know enough about his engines to keep them going."

Objection has been offered in Congress to any plan to encourage the transfer of British officers to American positions and supposedly to American citizenship on the theory that the interest and pride and ambition of the native Briton will always remain in British shipping. It has, indeed, been asserted that in some instances Englishmen have taken out "first papers" in the United States and have become officers of American ships without any intention of perfecting their citizenship. Mr. Munson has stated, however, that his observation and experience has been to the contrary. Relating the record of his own company, he stated: "We have had a very long experience with absorbing men who have come over here as British citizens to become American citizens. We changed vessels from the British flag to the American flag under the Panama Canal Act and we took over those men who were British officers, and nine-tenths of them became American officers."

The Labor Question in the Shipyards

His explanation of the disposition of an erstwhile British subject to stick as an American citizen, once he had become familiar with American shipping conditions, took into account the higher pay for both officers and men on American vessels, the superior accommodations and better equipment on the great majority of American vessels. Incidentally, this veteran shipping executive was asked as to the obvious difficulty of persuading American young men to take up the seafaring vocation as a life work. Mr. Munson's deduction was: "The American is willing to stick with the work if he gets to be an officer, but if he goes to sea as a seaman or if he goes to sea as a fireman, he does not stay. As a rule, he wants something better. That is particularly true of the coal-burning steamer; they do not like that kind of work because it is really heart-breaking work."

That the labor question is only slightly less important in the case of American shipbuilding than in the sphere of American ship operation was intimated by Homer L. Ferguson, president of the Newport News Shipbuilding and Dry Dock Company, in the course of a recent discussion at Washington. After remarking that the American shipbuilder has a certain advantage over his British rival "through not having to use a first-class mechanic

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for every job that looks like a mechanic should be doing it," he turned to the other side of the picture and, contrasting conditions on the opposite sides of the Atlantic, said: "We have a good many mechanics, but we have not really the same proportion of skilled mechanics that they have. In England, generally, a man may not join a union until he has served his apprenticeship. Now, that is a right hard restriction on some boys, but it does tend to turn out good mechanics. If there is any one business where mechanics are still used, it is shipbuilding, because it is not repetitive work."

The Newport News shipbuilder went on to explain, though, that just in proportion as shipbuilding approaches quantity production does American specialization give the advantage to the firm on this side of the Atlantic. By way of illustration, he related: "They will have a man take a plate, punch it, furnace it, roll it, plane it, transport it and put it on a ship and bolt it. That is an operation that we perform with at least seven different trades. We will use at our place four or five platers to plate all of the ships that we can build on twelve ways. In a yard of that size in England, on the average they might have 75. We only use our expert men to do the jobs which require expertness, so we make up on that, frequently, a difference in the cost. The result is that the higher grade the ship, the more nearly we come to their cost. There is a notion that the cheaper ships can be more easily built in competition with them. That is largely fallacy. We will come nearer building torpedo-boat destroyers at the same price as the British yards than almost any other type of ship. With the higher grade ships you get a greater benefit out of duplication than you do in the lower grade ships."

That frequency of payment of the wages of ships' crews is a seemingly insignificant detail that tends to complicate labor problems is the idea advanced at the Capitol by Charles H. Potter, president of the United States Ship Operators' Association. Mr. Potter takes the position that sailors receive their money too frequently for their own good and that the short intervals of payment are a decided disadvantage to ship operators in that frequently ships must be held in port in order to secure other men to replace those who have disappeared after receiving their pay. The prohibition laws now in force in the Capitol by Charles H. Potter, president of the United result in a better morale on the part of the men in the coastwise trade, but he does not hold, as do some prominent members of Congress, that the result of the "dry" laws will ultimately be to attract a better class of men to American ships whether engaged in the coastwise or in the foreign trade. The United States Ship Operators' Association has, as the result of a questionnaire sent to all of its members, sent to Washington a recommendation that the present maritime laws be so modified as to attain increased usefulness for American vessels without any material sacrifice of American standards.

Repairing Defective Propellers

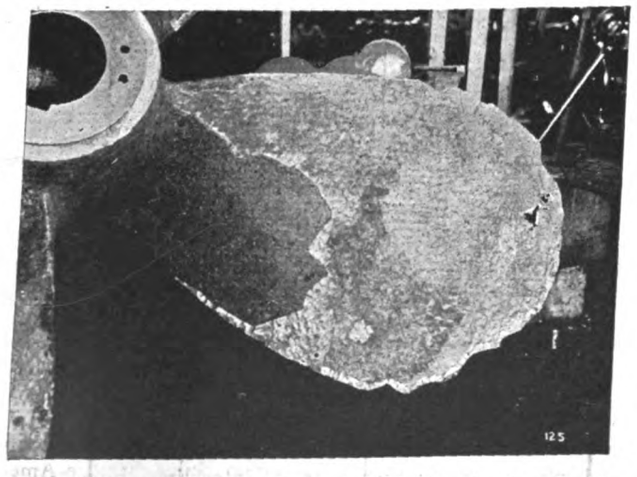
BY CHARLES T. PERRY

MUCH time and effort have been more or less wasted in the past by trying to repair broken or badly pitted propellers by welding cast iron tips to the blades with the oxy-acetylene torch or the electric arc.

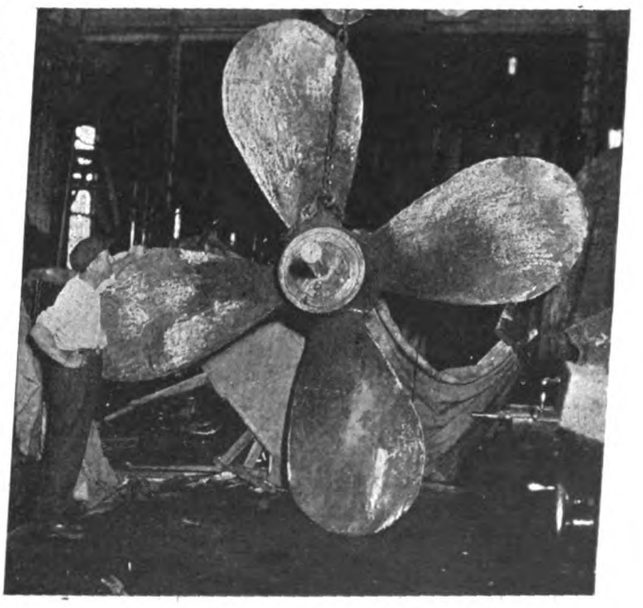
When the oxy-acetylene process has been used the excessive heating of the tip accompanied by an almost noticeable expansion and necessarily an equal contraction on cooling causes internal strains to be set up in the metal. When propellers repaired in this manner are subjected to stress they almost invariably break at the weld. Heating also tends to warp the blade badly, because of its wide area and relatively small thickness.

The electric process is found to be objectionable in certain respects, although the results obtained in repairing propellers by this means has been more satisfactory than when oxy-acetylene has been used. Fractures are frequently found near the weld after a repaired wheel has been put back in service. The only apparent reason for fracturing is the fact, that because of the slightly different composition of the material in the weld than the rest of the blades a galvanic action is set up which in time causes pitting along the line of the weld.

The engineering department of New York City has developed a method of repairing the broken cast steel propellers of the municipal ferries, which are subjected to unusually rough usage. The method consists in thoroughly cleaning all broken edges and pitted places, filling them in by the electric welding process and building up the tips to their regular size by this means. Special jigs



Propeller Blade Cleaned and Ready for Electric Arc Repair Process



On the Final Inspection This Repaired Propeller Proved to be Less Than Two Pounds Out of Balance

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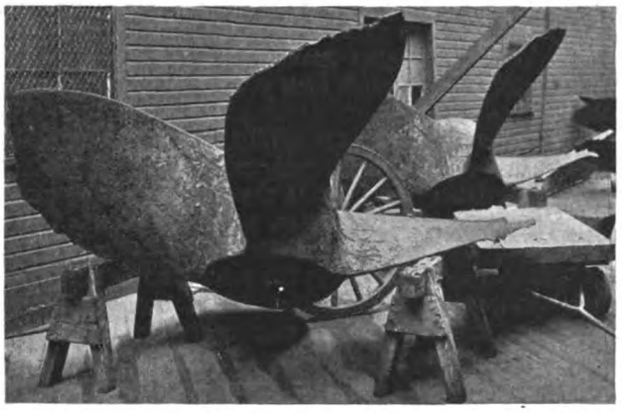

Scrapped Propellers That Have Been Salvaged and Repaired by Building Up Tips by Means of Electric Arc Welding

and templates are used, to maintain the proper blade thickness and contour. After welding, the wheels are dressed with portable grinders. Excessive heating of the tip is prevented throughout the welding operations and no line on the fracture is established.

With slight modifications and different electrodes the same process might be adapted to the repair of cast iron and alloy propellers. A metallic electrode should be used with a voltage not over 40 in any case, and the best of materials and workmanship are essential to insure a successful repair. The welded edges and tips of a propeller seem to stand concussion better than the original metal.

Attachment for Hydraulic Systems

A DEVICE to be used in connection with an hydraulic system, especially with a telemotor employed as the operating gear for a marine steering engine, has been invented by Frank J. Davis, of the Union Plant, San Francisco, Cal., of the Bethlehem Shipbuilding Corporation, Ltd.

INSTALLATION

The attachment is to be installed at the highest point of an hydraulic system and used to vent accumulated air and to admit liquid from an outside source of supply. The valve provided to control the escape of air is normally maintained in a closed position by the liquid in the system, but is arranged to open automatically by the pressure of an air pocket at the valve. This air vent valve is also arranged to admit liquid as the valve is vented, so that a control is provided for closing it after the venting action has ceased. The device may be used to replace the closing plug now employed in heads forming part of an hydraulic system. In Fig. 1 is shown a sectional view of the attachment.

DETAILS OF DEVICES

The installation includes a valve casing which fits onto a threaded nipple attached to the head. A lateral pipe connects this casing with a tank. This tank contains a supply of liquid used for floating the valve, which is mounted on a cork float. The valve seat is arranged at the base of the vertical port in the casing, the upper end of the port communicating with the chamber in the valve casing, to which a pipe leads from the tank. A guide stem having lateral wings fitting the vertical port is secured to the valve and permits the flow of air or liquid along the stem. When in a lowered position, the float is allowed to rest on raised projections on the top of the fitting within the casing, lateral passages being provided to maintain free communication between the interior of the valve casing and the bore of the fitting.

By reason of the bore, the interior of the valve casing which forms the float chamber is always in communication with the hydraulic system through the head, so that under normal fluid conditions the liquid in the system will maintain the float when the valve is closed. The formation of an air pocket, however, in the head, and hence in the float chamber of the valve casing, will permit the float to drop by its own weight, the valve thereby venting the casing and permitting accumulated air to escape through the port, chamber and pipe to the tank. At the same time the liquid will flow through the pipe to the float chamber, so that upon restoration of the normal liquid conditions in the system, and hence in the head, the float will rise and close the valve.

A shut-off valve is provided, arranged to seat within the casing at the upper end of the port. The stem of this valve extends upwards through the top of the casing. It is provided with a hand wheel for operating the valve.

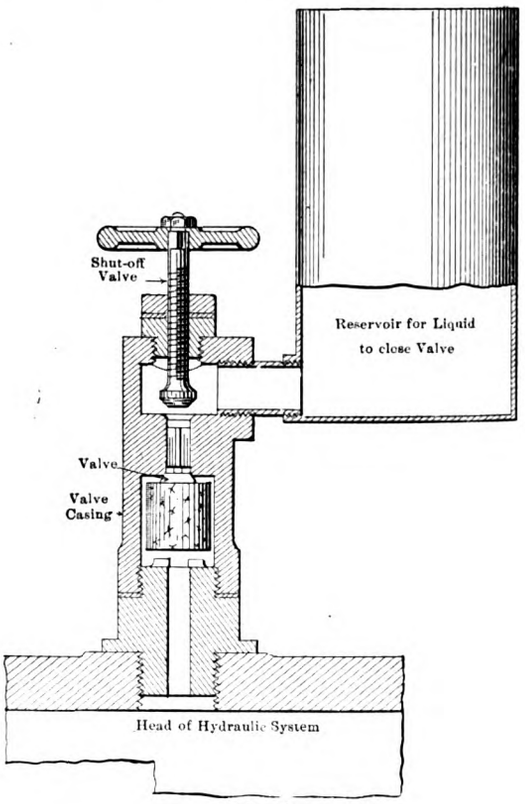

Fig. 1

The valve stem extends through and has a threaded connection with a nut and lock nut above the casing, suitable packing being provided between the nuts.

Institution of Naval Architects to Hold Summer Meeting in Liverpool

The council of the Institution of Naval Architects has accepted an invitation to hold a summer meeting in Liverpool on July 6, 7 and 8 which has been extended to the Institution by the Lord Mayor of Liverpool. Meetings for the reading of papers will be held, and arrangements will be made to visit some of the principal shipbuilding and other works in Liverpool and its vicinity.

Applications for membership or associate membership should reach the secretary not later than June 28, and for associates or students not later than July 3.

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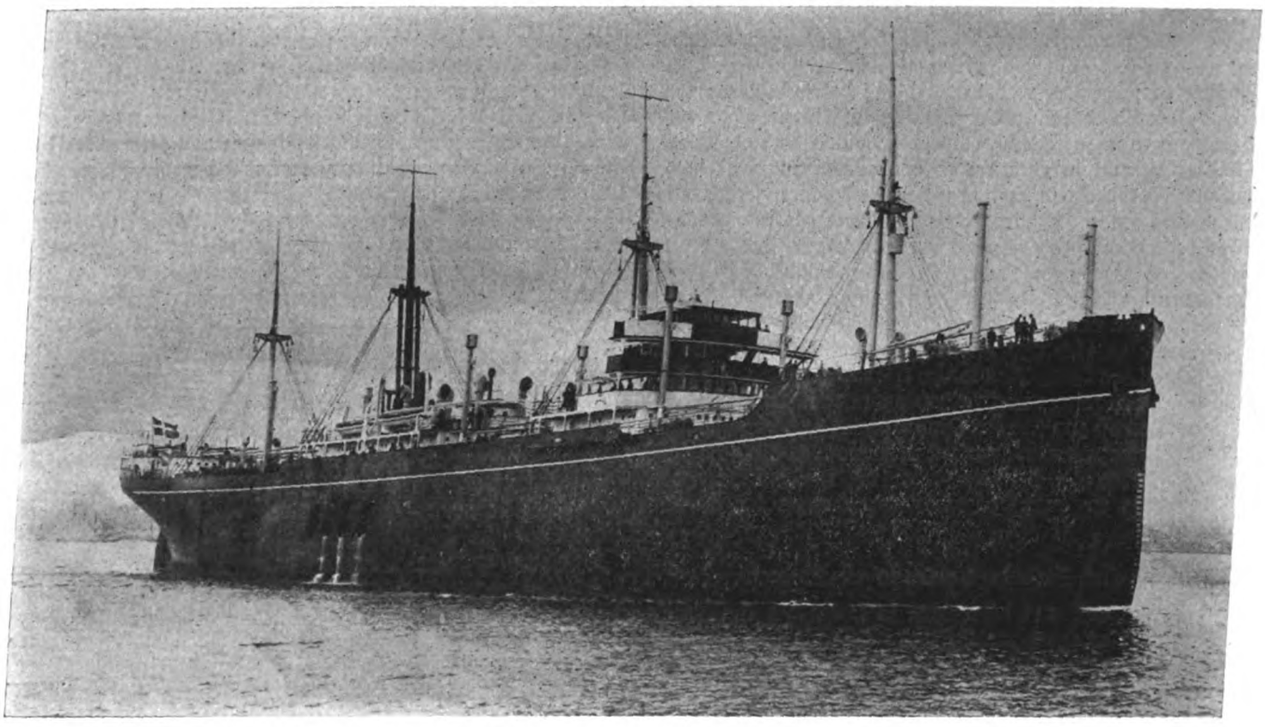

13,000-Ton Motorship *Afrika* Built by Burmeister and Wain for the East Asiatic Company. Two 2,250 Indicated Horsepower Diesel Engines are Installed

Motorship Building in Europe

Trials of 13,000-Ton Motorship Afrika—Fast Motorship Launched for Glen Line—Activities in France

BY OUR SPECIAL LONDON CORRESPONDENT

TWO very important events in motorship building in Europe have occurred during the past month. In the first place, the largest internal-combustion-engined ship which has yet been completed ran her trials at Copenhagen and, secondly, an even bigger and faster vessel was launched at Glasgow. The first-named craft, which is the *Afrika*, built for the East Asiatic Company by Burmeister and Wain, carries 13,000 tons of cargo, has a speed of about 12 knots and a fuel consumption of only 15 tons of oil per day. The type has now been adopted as a standard by the East Asiatic Company and a number of similar vessels are under construction, as it is the belief of most shipping firms in Europe that the high speed and large class of cargo vessel will prove more economical in the future than the average 10-knot, 6,000-ton type which has hitherto been mostly employed.

There is no special novelty in the machinery of the *Afrika*, the propelling plant comprising a couple of six-cylinder Burmeister and Wain standard engines developing 2,250 indicated horsepower each, or about 1,750 brake horsepower. They have cylinders 740 millimeters stroke and 1,150 millimeters bore and run at 115 revolutions per minute for normal power. The auxiliary machinery perhaps is of more interest. Needless to say, it is all driven by electric motors, as Scandinavian motorship owners are now fully convinced that this system is infinitely preferable to the adoption of steam auxiliaries, owing to the saving in fuel which is effected. Three separate electric generating sets are installed, each driven by a two-cylinder, four-cycle Diesel engine, the generators having an output of 65 kilowatts at a voltage of 220. When in harbor and all the winches are in operation, two sets will be required, but at sea only one is necessary, so that there are usually two spare plants and always a minimum of one to act as a stand-by.

A 14,000-Ton Motorship

In addition to the completion of this new ship, the second occurrence of unusual interest during the past few weeks is the launch of a fast motorship, which, when completed, will be even larger than the *Afrika*. This vessel, named the *Glenogle*, has a deadweight carrying capacity of 14,000 tons and has been built for the Glen Line by Messrs. Harland and Wolff at Glasgow. Not only is she a good deal bigger than the *Afrika*, but she will be one of the fastest cargo vessels afloat, having a speed of between 14 and 14½ knots. In order to attain this relatively high speed, two Diesel engines of 3,200 indicated horsepower are to be installed. They are eight-cylinder sets, of the same designed power as those fitted in the motorship *Glenapp*, but many modifications have since been made, and they represent a type which Harland and Wolff is now standardizing for installation in a large number of motor vessels under construction.

It will be noticed that one of the features of European motorship building is for the speed of the newer vessels to be much higher than is generally considered advisable for the average cargo boat, and quite the majority of internal-combustion-engined vessels which are now being built at European yards have a speed of from 12 to 14

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knots. The *Glenogle,* which is 502 feet in length, with a beam of 52 feet (dimensions exactly similar to those of a number of passenger and cargo boats being built by the New York Shipbuilding Corporation in which steam machinery is to be installed), is to be provided with electrical auxiliaries, and in addition to cargo carrying will have accommodation for a limited number of passengers. It is clear that we are gradually tending towards the production of motor passenger ships, and there are already rumors that Harland and Wolff contemplates building such craft at their Belfast yard, where extensions have recently been carried out for the engineering shop.

A week or two ago another motorship was added to the Glen Line fleet. She is the *Glentara,* which is one of the types of motor vessels carrying 10,500 tons fitted with a couple of oil engines developing about 3,000 horsepower. A similar vessel was launched at Belfast also by Harland and Wolff in April. She is for the Bibby Line, which thus enters the ranks of motorship owners for the first time.

Oil Engine Building in France

Hitherto little has been done in motorship construction in France, but there are signs of awakening activities, and Schneider and Company is building eight single-screw, 4,000-ton vessels, in each of which this company is to install one of its new type 1,500-brake-horsepower, two-cycle engines with six cylinders. These motors possess many features of unusual interest. In the first place, they are perhaps the only design built by any important engineering concern in which scavenging valves in the cylinder cover are still retained, the more usual method being, of course, the employment of ports at the bottom of the cylinder uncovered by the piston in the course of its stroke. The Schneider Company has, however, had considerable experience in valve scavenging and apparently prefers to continue its adoption at any rate on engines of this size. There are six cylinders, 540 millimeters bore and 800 millimeters stroke, the speed of revolution for 1,500 brake horsepower being 140 revolutions per minute. A three-stage air compressor is mounted on the end of the crankshaft in the usual way, while the scavenging pumps, of which there are two, are driven by means of beam levers off the crossheads of the two central cylinders. There are four scavenging valves in each cylinder cover in addition to the fuel inlet valve, and the exhaust is, of course, discharged through the exhaust ports at the bottom of the cylinder, which have the advantage of occupying the whole of the periphery; this is not possible in the ordinary port scavenging design. The engine, which is of the crosshead type, is built up with a box framing, which gives an open design with accessible main crankshaft bearings.

Those British shipbuilders who have not yet started constructing oil engines are showing great haste to take up its manufacture, as they are being pressed on all sides to produce motorships as quickly as possible. Alex. Stephen and Sons, one of the oldest-established Clyde shipbuilding firms, which has hitherto kept aloof from oil engine development, has now acquired a license for the Sulzer Diesel engine. Among engineers who have had experience with various types of Diesel motor it is considered that this Swiss-built engine is likely to become one of the most widely adopted in the future for ships, and the fact that two such famous concerns as Armstrong Whitworth and Stephens have both adopted it as their standard oil engine is a strong point in its favor.

The builders of the Sulzer engine claim a big advantage over the four-cycle type in the diminished weight and the smaller engine room. With two engines each of about 1,500 indicated horsepower, the weight of the total installation for the Sulzer plant is only about 320 tons, against over 500 tons for a corresponding four-cycle Diesel plant. On the other hand, the believers in the four-cycle type claim that, while this design has proved its reliability in service over many years, the two-cycle engine has yet to reach this position, while there is no doubt that the four-cycle type is more economical in fuel consumption than the engines operating on the two-stroke principle. The difference, however, is not very marked and probably not more than about 5 percent as a maximum.

Large Passenger Liner Under Construction at Wallsend Shipyard

ON February 7, Messrs. Swan, Hunter and Wigham Richardson launched from the berth once occupied by the famous Cunard liner *Mauretania* at their Wallsend shipyard a 20,000-ton passenger vessel which is being built for the Navigazione Generale Italiana, of Genoa. This ship, called the *Giulio Cesare,* is to run in the owners' service between Genoa and Buenos Aires, and will be one of the most luxurious of the many passenger liners plying between Europe and Argentina. The overall length of the vessel is 633 feet, and the breadth 76 feet, with a molded depth of a little over 50 feet. The ship has a straight stem and a cruiser stern.

The propelling machinery and boilers have been built by the Wallsend Slipway and Engineering Company, Ltd. The main engines consist of four geared turbines driving four propellers. The high- and low-pressure turbine units work in series, which arrangement applies both to the ahead and astern direction of rotation. The steam is superheated up to 200 degrees F. on entering the turbine maneuvering valves. In case of a breakdown to any of the turbines, they are arranged so that the high-pressure and low-pressure units can be operated independently. There are six double and four single-ended multitubular boilers placed in four watertight compartments. The working pressure of the boilers is 222 pounds per square inch, under Howden's forced draft. The designed speed of the ship is 19½ knots on a 24 hours' continuous trial.

The *Giulio Cesare* has eight decks, which are chiefly occupied with accommodations for 1,800 passengers, of which 210 are first class, 310 second class, and the remainder emigrants.

The *Giulio Cesare* is fitted throughout with hydraulic lifting gear for passengers' baggage, stores, and a small amount of cargo. An extensive electric generating plant will be installed in the ship for lighting, and also to work the first-class passenger lift and other lifts dealing with stores, etc. For the provision rooms there will be a large installation of refrigerating machinery supplied by Messrs. J. & E. Hall, of Dartford.

The *Giulio Cesare* is being built to the requirements of the Registro Nazionalo Italiano, of Lloyd's and of the British Corporation. She will also fulfill the provisions of the Merchant Shipping Laws of Italy, Great Britain and the United States, especially as regards carrying passengers and emigrants. When designing the ship, a great deal of attention was paid to ensure her safety as far as possible by providing a sufficient number of watertight compartments. A very effective installation of watertight doors controlled from the bridge is being installed by Messrs. J. Stone & Company of Deptford, London. On the boat deck, Welin's patent davits are fitted. Electric boat winches are provided for lifting all the midship lifeboats, which include two motorboats. The ship also carries submarine signalling apparatus which will be invaluable for picking up position in fogs.

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Testing the Hull Structure of Ships

Test Schedule for Cargo Vessels—Rules and Methods for Testing Peak and Ballast Tanks and Forward Collision Bulkhead

BY F. K. RUPRECHT

THE testing of the various parts of the finished hull structure of a steel vessel is a subject of great importance. As a rule, this matter is given very little attention until the time of test arrives and consequently a great deal of needless confusion and delay, as well as great expense and waste, is the result.

The usual practice in shipyards is to designate a testing foreman, who chooses a gang of men to assist him in preparing the structure to be tested and to assist in the test itself. This gang carries on the preliminary tests and does whatever work is necessary in order to have the tank, bulkhead or deck, as the case may be, pass muster. Only in a very few yards is testing work carefully planned and scheduled and otherwise given the attention it deserves. It is a most common occurrence to come across a job where no one in the yard is sure what kind of a test and how severe a one is required on a given piece of work. As a result, the testing is done blindly, or upon hazy and incorrect instructions to the foreman in charge. This has, to the author's personal knowledge, resulted in severe damage to tank tops and bulkheads by subjecting them to a pressure in excess of what was called for by the classification rules, as well as in excess of the design conditions.

A ship is designed and built to perform a certain work. To perform his work satisfactorily is the function of the ship. Now, parts of the structure will be called upon to perform certain kinds of work, and the object of testing is to insure the owners and underwriter that they are capable of rendering this service; hence the real culmination of the shipbuilder's efforts is (or should be) to pass the test. Looking at the matter from this view, the importance of the test is seen and the work should be planned accordingly.

Take, for example, a tank ship to carry fuel oil. It makes no difference how pretty the workmanship may be, the shell, bulkheads and decks must be tight under the test head prescribed by the classification society before the workmanship is passed as satisfactory. No matter what nice lines and proportions or finish this vessel may have, she is not an insurable risk for the underwriters, unless the tanks have been tested and passed by an accredited surveyor.

We have all heard the catch phrase, "The play's the thing," as applied to the moving pictures. In shipbuilding "the test's the thing."

Having come to the conclusion that testing is a highly important part of the work, it is surprising to see so little information on this subject available. All the necessary information is given in the rules of the various classification societies, but it is scattered around in all the numerous sections. An attempt is made in this paper to gather it together and present it in a concise form for quick and easy reference. A few notes are also given on procedure, which may be of value to shipbuilders.

Test Schedule for Cargo Vessels

TEST NO. 1—FORE PEAK TANK

(*a*) *Object*

To test tightness and strength of peak bulkhead, shell in way of tank, deck forming crown of tank, manholes and pipe connections to tank top, bulkhead or shell.

(*b*) *Classification Societies' Rules*

1.—American Bureau of Shipping and British Corporation Registry.

To be tested with head of water equal to load draft, or .66 × depth of vessel, or with head to one foot above highest point to which water may rise in service condition, whichever is greater.

(Note.—Highest point to which water may rise would be top of vent pipe, overflow pipe or filling connection, whichever is greater.)

2.—British Lloyd's Register.

To be tested with a head of water eight feet above the top of the tank, or with a head to the height of the load waterline, whichever is greater.

3.—Bureau Veritas.

To be tested with a head of water eight feet above the top of the tank, or with a head to the height of the load waterline, whichever is greater.

(*c*) *Procedure of Testing*

Test before cementing or cement washing or painting with bitumastic, and, if possible, before launching and after all work within and adjacent to tank has been completed and the workmanship has been inspected and passed by the surveyor. If it is necessary to test before the surveyor has inspected the workmanship, due to launching date or other contingencies, the final approval of test cannot be given until such workmanship has been passed. Any finding of the inspector which makes necessary work which may affect the tightness of the structure will make a retest obligatory.

Fit stand pipe onto tank top (vent or filling connection may be used) and carry pipe to prescribed height fitting large funnel or other container at top, the height of which is to be such as to show the level of water when at the testing head. No leaks or defects should develop at this pressure, and any found should, of course, be made good by legitimate means to the satisfaction of the surveyor. Often it is not possible to test completely before launching, and in this contingency it is necessary to have a preliminary test to insure the tightness of the shell in way of tank. In this case the tank is filled with water to the level of the crown of the tank and the shell made tight to the satisfaction of the surveyor.

TEST NO. 2.—AFTER PEAK TANK

(*a*) *Object*

To test tightness and strength of bulkhead, shell in way of tank, deck forming crown of tank, manholes and pipe connections to tank top, bulkhead, or shell.

(*b*) *Classification Societies' Rules*

1.—American Bureau of Shipping and British Corporation Registry.

To be tested with head of water equal to load draft, or .66 × depth of vessel, or with head to one foot above highest point to which water may rise in service condition, whichever is greater.

(Note.—Highest point to which water may rise would be top of vent pipe, overflow pipe or filling connection, whichever is greater.)

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2.—British Lloyd's Register.

To be tested with a head of water eight feet above the top of the tank, or with a head to the height of the load waterline, whichever is greater.

3.—Bureau Veritas.

To be tested with a head of water eight feet above the top of the tank, or with a head to the height of the load waterline, whichever is greater.

(*c*) *Procedure of Testing*

Test before cementing or cement washing or painting with bitumastic, and, if possible, before launching and after all work within and adjacent to tank has been completed and the workmanship has been inspected and passed by the surveyor. If it is necessary to test before the surveyor has inspected the workmanship, due to launching date or other contingencies, the final approval of test cannot be given until such workmanship has been passed. Any finding of the inspector which makes necessary work which may affect the tightness of the structure will make a retest obligatory.

Fit standpipe onto tank top (vent or filling connection may be used) and carry pipe to prescribed height fitting large funnel or other container at top, the height of which is to be such as to show level of water when at testing head. No leaks or defects should develop at this pressure, and any found should, of course, be made good by legitimate means to the satisfaction of the surveyor. Often it is not possible to test completely before launching, and in this contingency it is necessary to have a preliminary test to insure the tightness of the shell in way of the tank. In this case the tank is filled with water to the level of the crown of the tank and the shell is made tight to the satisfaction of the surveyor.

TEST NO. 3—DOUBLE-BOTTOM BALLAST TANKS

(*a*) *Object*

To test tightness of shell plating in way of double-bottom, tank top plating and margin plate, strength and tightness of watertight floors and centerline division plating (centerline girder), manholes and pipe connections to tank top, watertight floors, centerline girder or to shell.

(*b*) *Classification Societies' Rules*

1.—American Bureau of Shipping and British Corporation Registry.

To be tested before launching and before cementing with head of water up to freeboard deck or to the top of overflow from air pipes, whichever is highest.

2.—British Lloyd's Register.

To be tested with head of water to the height of the load waterline.

3.—Bureau Veritas.

To be tested before launching with head of water corresponding at least with the height of the load waterline. In any case, the head of water must not be less than eight feet above the crown of the tank.

(*c*) *Procedure of Testing*

Test before launching and before painting with bitumastic or cementing or cement washing, and after all work within and adjacent to tank has been completed and the workmanship has been inspected and passed by the surveyor. If it is necessary to test before the surveyor has inspected the workmanship, due to launching date or other contingencies, the final approval of test cannot be given until such workmanship has been passed. Any finding of the inspector which makes necessary work which may affect the tightness of the structure will make a retest obligatory. This would necessitate placing the vessel in dry dock. Each tank to be tested separately so all sides of divisional floors or girders such as watertight centerline girder may be observed.

Fit standpipe to tank top (vent or filling line may be used) with large funnel or other container at top and at such a height that the level of water at the required head will show in the container. No leaks or defects should develop at this head, and any found should be made good by legitimate means to the satisfaction of the surveyor.

TEST NO. 4—DEEP BALLAST TANKS

(*a*) *Object*

To test the strength and tightness of the boundary bulkheads, deck forming crown of the tank, shell in way of tank, inner bottom in way of tank in double-bottom vessels, all manholes, hatches, hatch covers and pipe connections to tank top, inner bottom, bulkheads or shell.

(*b*) *Classification Societies' Rules*

1.—American Bureau of Shipping and British Corporation Registry.

To be tested with head of water equal to load draft, or .66 × depth of vessel, or with head to one foot above highest point to which water may rise in service condition, whichever is greater.

(Note.—Highest point to which water may rise would be top of vent pipe, overflow pipe or filling connection, whichever is greater.)

2.—British Lloyd's Register.

To be tested with a head of water eight feet above the top of the tank, or with a head to the height of the load waterline, whichever is greater.

3.—Bureau Veritas.

To be tested with a head of water eight feet above the top of the tank, or with a head to the height of the load waterline, whichever is greater.

(*c*) *Procedure of Testing*

Test before launching and before painting with bitumastic or cementing or cement washing and after all work within and adjacent to tank has been completed and the workmanship has been inspected and passed by the surveyor. If it is necessary to test before the surveyor has inspected the workmanship, due to launching date or other contingencies, the final approval of test cannot be given until such workmanship has been passed. Any finding of the inspector which makes necessary work which may affect the tightness of the structure will make a retest obligatory.

Fit standpipe to tank top (vent or filling line may be used) with large funnel or other container at the top and at such a height that the level of water at the required head will show in the container. No leaks or defects should develop at this head, and any found should be made good by legitimate means to the satisfaction of the surveyor.

Often it is not possible to test completely before launching, and in this contingency it is necessary to have a preliminary test to insure the tightness of the shell in the way of the tank. In this case the tank is filled with water to the level of crown of tank and shell made tight to satisfaction of the surveyor.

TEST NO. 5—FORWARD COLLISION BULKHEAD

(*a*) *Object*

To test strength and tightness of the bulkhead and tightness of all connections thereto. While the shell must, of course, be tight, the test is primarily to test the bulkhead.

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(*b*) *Classification Societies' Rules*

1.—American Bureau of Shipping and British Corporation Register.

No definite rule to cover this particular case. Appears that a hose test is all that would be required. Pressure in nozzle to be at least 30 pounds per square inch.

2.—British Lloyd's Register.

To be tested by filling the peaks with water to the height of the load waterline.

3.—Bureau Veritas.

To be tested by filling the fore peak with water. (Note.—No head is given, but it is assumed that it shall be to the freeboard deck, or at least to the load waterline.)

(*c*) *Procedure of Testing*

Test before cementing, cement washing or painting with bitumastic and before launching, if possible, although the latter is not a requirement, and after all work within and adjacent to bulkhead has been completed and the workmanship has been inspected and passed by the surveyor. If it is necessary to test before the surveyor has inspected the workmanship, due to launching date or other contingencies, the final approval of test cannot be given until such workmanship has been passed. Any finding of the inspector which makes necessary work which may affect the tightness of the structure will make a retest obligatory.

Fill the fore peak compartment, i. e., that space between the stem and the collision bulkhead, with water to a height equal to *at least* the load waterline. If there is a calked watertight deck above this level it is well to fill to this level, since this would be more nearly the head the bulkhead must withstand in case of a damaging collision. No leaks should develop at this head, and the deflection of the bulkhead should be reasonably small. Any leaks which are found should be made good by legitimate means, and any excess deflection should be corrected by additional stiffening, all to the satisfaction of the surveyor.

(*To be continued.*)

Stoke-Hold Efficiency—IV

BY A. POHLMAN

IN preceding articles the flue gas analyzer and draft gage were described and their uses explained. There remains, however, another very important instrument for use in the work of improving stoke-hold efficiency, and that is the pyrometer, which is used for temperature readings.

Pyrometers of the expansion or of the electrical type are most commonly used. Of the two types the electrical instrument is the more desirable, inasmuch as several thermo couples may be placed at various points and connected to a meter at some convenient place by means of leads, so that by means of a switch readings can be taken from the different couples. The expansion instrument, on the other hand, must be carried from one point of reading to another.

In the case of a watertube boiler installation a pyrometer pays for itself many times over, as by its use broken down baffles, causing a short circuiting of the flue gases and a consequent loss of efficiency, are detected at once. Temperature readings in the different passes of the flue gases should be taken daily. If the readings fail to show a drop in temperature from one pass to the next, they usually indicate broken baffling. If the readings show a higher temperature in the back end, where the baffling is known to be secure, it shows that secondary combustion has taken place. This means that all the mixture is not being manufactured in its proper place—the firebox.

A very common cause for low CO_2 and high temperatures in the wrong place in watertube boiler installations, where the header type of boiler is used, is the lack of proper packing between headers.

The effect of soot on the heating surface of a boiler is also quite apparent when the pyrometer is used. Wherever the heating surfaces are accessible they should be cleaned of soot at least once a day, and for this purpose the mechanical soot blower should be used. Blowing with a hose and lance is a nasty and expensive job, and very often the apparatus is not available. At the best, where the hand method is used, the soot is blown from one corner to the other and the surfaces are not effectually cleaned.

Where superheaters are installed in the uptakes, as in Scotch boilers, special care should be taken to be certain that the superheating surface is well cleaned of soot. With the mechanical type of soot cleaner the heating surfaces may be blown free of soot and the whole operation can be carried out in a few minutes for each boiler. When it is realized that a layer of soot one-fifth of an inch thick forms as effective a heat insulator as a covering of fine asbestos one inch thick, it will be understood why the same attention should be paid to the soot-cleaning problem as is paid to the old bugaboo of scale removal. If shipowners realized how much the old "lance" method of cleaning heating surfaces actually costs in dollars and cents, every vessel would be equipped with a mechanical soot blower.

While many of the suggestions which follow may seem like old chestnuts to many old-time operators, nevertheless, the writer has seen so many cases both afloat and ashore where they have been utterly disregarded that he feels that attention should be called to them here. Although individually they may appear to be of little account, nevertheless experience proves that collectively they are a decisive factor in reducing fuel cost.

In the first place, a routine working schedule should be laid out, and nothing short of an emergency job should be permitted to cause a deviation from it. If the work is carried out in accordance with the schedule and is well done, it will be found that there will be less emergency work done. It must be remembered that loss of time at sea runs into money, and if we expect to compete with foreign vessels, this type of loss must be reduced to a minimum.

In laying out a working schedule, first plan to clean each boiler thoroughly—say every sixty to ninety days, depending upon the particular conditions. When the boiler is down, make certain that the check valves, blowdown valves, etc., are examined regardless of whether they have indicated any defects or not. Attention must also be paid to water columns and fittings, for leaky trycocks may very easily be responsible for the needless loss of a few tons of coal a year. Gage glasses should also be replaced at this time, as very likely their thickness inside the packing nuts has been worn down. If not replaced, sooner or later they will let go at sea and the replacing of a gage glass at sea means a drop in steam pressure and a reduction in the revolutions of the engine. The ash ejector should be carefully examined at least once a month. It does not cut up often, but when it does it usually makes things hum.

The same sort of schedule should be applied to oil-

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burning equipment. Do not wait for accidents to happen, get there first on the "stitch-in-time" principle. Examine all valve disks at a specified time. If a disk shows signs of wear, replace it.

It is not assumed that an engineer can look after all these minor details personally, but systematic distribution of the stoke-hold work among the water tenders, supervised directly by the second assistant, who is usually in charge of the boilers, will go a long way towards securing the necessary attention to the many small but important details which are so often overlooked. A water tender should be given a certain part of the equipment to look after, and he should be held responsible for this. Assume, for instance, that water tender *X* has, among other equipment, No. 1 boiler. While on steaming watch *X* feels the blow-down pipe back of the valve of No. 1 boiler to discover if there are any signs of heating, which would indicate a leaky valve. He does the same with the water column drains, etc. Assume, for example, that he discovers a leaky blow-down. He now turns to a note book, which may be called the "boiler trouble book," and on the page headed "No. 1 Boiler" he enters the information regarding the leaky valve, together with the date on which it was discovered. This book serves as a record of the work that must be done when the boiler is let down. Oftentimes, unless someone happens to remember it, a boiler will be fired up after overhauling with the try-cocks leaking, simply because the leak did not show when the boiler was "dead."

All the larger valves should be inspected and operated and graphited at a specified time. The fact that this was done should be entered in the log slate. The slate is used not because a record is needed, but because the man to whom this work was allotted is more apt to do it if he has to go on record as having fulfilled his task. The packing, etc., of the smaller valves and keeping them tight should also be divided up in a like manner, and leaky stuffing boxes should be investigated by the man who is detailed for such work in his section. The use of this system, it will be found, eliminates to a great extent the passing of the buck and the "let George do it" spirit.

Another feature well known to any engineer is the desirability of maintaining a fixed water level. It has been the writer's experience that this condition is improved by placing a piece of tape around the glass at the steaming level where it is always in sight. The men should also be made to realize the importance of the functions of the feed water heater.

A record should be kept of the work done and the type of material used, as this record will show the life of the various materials and the time saved by their use. This record, therefore, will serve as a valuable guide in ordering supplies for future use. It is assumed, of course, that a regular log is kept to show up increased efficiency and economy.

While all of the foregoing may sound like additional work, it actually does not result in a lot of extra work. It is simply a method of distributing the work and eventually will involve the use of much less energy.

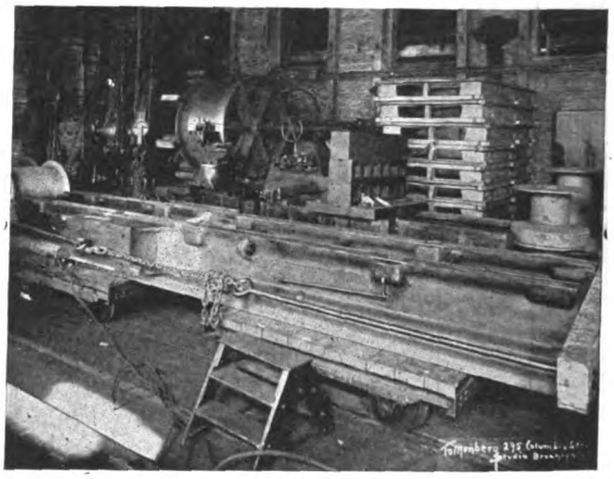
In conclusion, the writer asks the indulgence of those familiar with the methods suggested in the hope that those not so well versed in the subject may benefit from these suggestions. Technicalities have been avoided in order to simplify the subject, and it is sincerely hoped that the American marine engineer will take advantage of every means available for improving the efficiency and economy of the vessels which comprise the new American merchant marine.

Cast Iron Planer Bed Welded

CAST iron offers many difficulties to the welder, and some of the difficulties are incident to the design of the parts welded rather than to the cast iron itself. The job shown in the accompanying illustration is interesting principally on account of the fact that the weld had to be made without appreciable distortion of the parts, and the joint had to be finished so that the weld could not be readily detected.

The job in question relates to a large planer bed 20 feet long and weighing approximately 12 tons. This bed is part of a 60-inch planer and was broken into two parts approximately in the middle. The line of the break was 84 inches, and the welding was done from both the inside and the outside, making an external welding line of 168 inches.

In doing this work it was first necessary to assemble the parts in exact alinement and position. This was done by setting up two long inverted "V's" and laying the planer bed upside down on these "V's"; then the parts



Welded Planer Bed

were drawn together with screws in a huge clamp, as shown in the illustration. Having cut out the joint with air tools, the welding was done according to usual practice, using a steel pencil and special steel reinforcing plates. When finished, the exterior surface was ground flush with that of the original casting, so that were it not for the chalk put on for the purpose of photographing, the weld would be entirely invisible to the eye.

There are two remarkable achievements in this job: first, the absence of distortion and, second, the strength of the joint. The absence of distortion is proved by the fact that the ways were in perfect alinement when the job was completed, and, furthermore, a spiral gear with its bearings, which was located in the middle right adjacent to the weld and incidentally interfered considerably with the welder, was found in perfect alinement after the job was completed.

As for strength, this was tested at two different times—first, when the welding was about two-thirds done it was necessary to turn over the bed. This was done by putting a sling around the middle at the weld and hoisting, which put the maximum strain of the weight of the bed on the weld. During the operation of turning over, the bed was dropped some three or four inches on the floor and was bumped around considerably, all of which put excessive strains on the partially completed weld, and yet there was no sign of weakness. The work was done for the Lidgerwood Manufacturing Company by The Electric Welding Company of America, who employ the weldcraft process.

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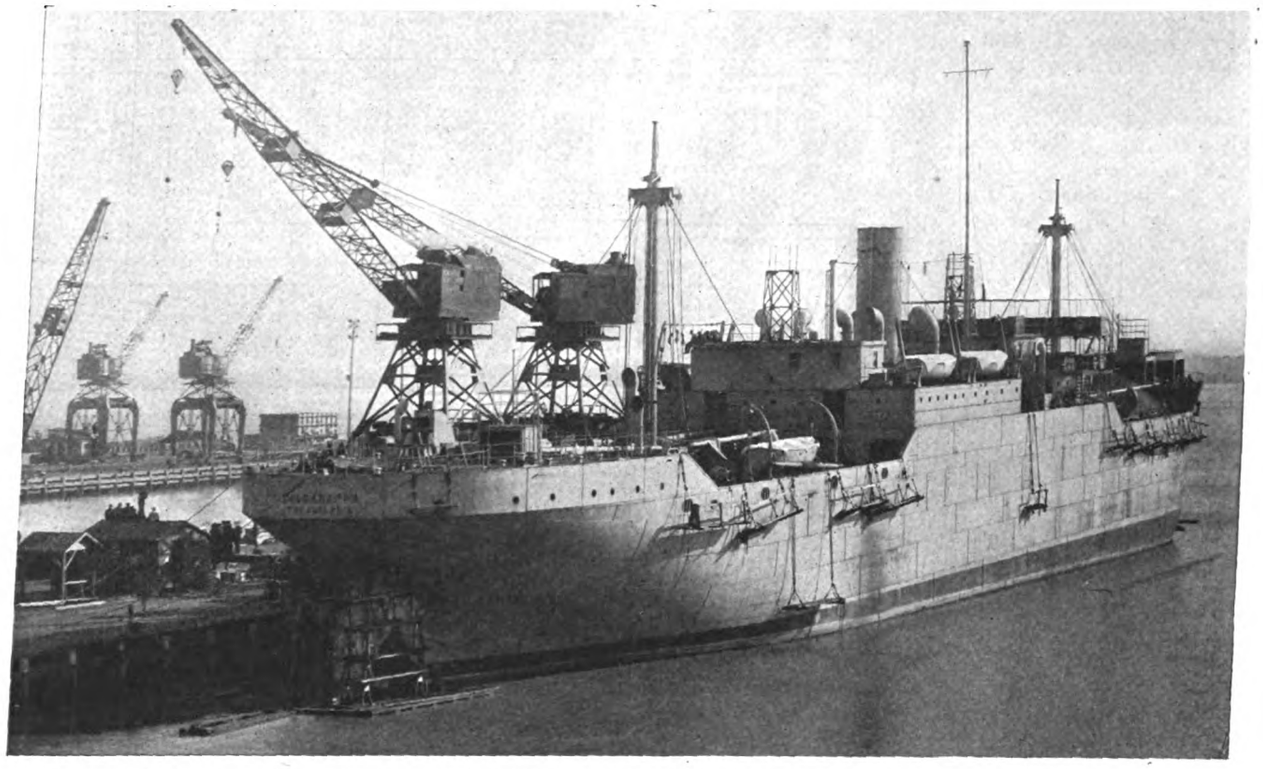

Fig. 1.—Open Pier Equipped with Full Arch Gantry Cranes for Loading and Discharging Ocean-Going Vessels

Pier Design for Ocean and Lake Terminals

BY H. MCL. HARDING*

This article describes plans and designs for piers for marine terminals, and especially for piers to be used by freight-carrying ships. The designs for piers differ materially from those for quays, which were described by the author in a recent issue of this journal.

THERE are many features to be considered in designing a pier which do not apply to quays. Considering these there are differences of opinion which may be called the difference between the rule of thumb practice and uninfluenced engineering principles. The one is derived from a limited or local practice at one port, and the other from a knowledge and study of all ports throughout the world. Among these may be mentioned, width of piers, width of slips, dimensions and location of sheds and often of the piers.

There are also questions in determining the width of sheds in proportion to the width of the piers, types of substructures for sustaining the sheds, the number of sheds on piers, number and height of the stories, number and location of the railway tracks, the railway and dray approaches to the piers, the position and cubical contents of the warehouses, location of the dray roads, length of storage railway tracks and many other features, all of which will be herein treated and the deductions given.

It is the desire that there may be such practical information derived from a study of the facts herein presented that where the conditions are suitable the terminal substructure and pier and superstructure may be planned and designed in accordance with the latest and best terminal engineering practice and free from any prejudice, influence and provincialism.

While there are exceptions to the principles given and also various types of construction, nevertheless it is deemed better to recommend those that after study and practical experience seem to be the best for general adaptation. Such a discussion of terminal engineering should be of more value than to follow a method of giving many examples of different pier design and thereby leave a confusion of ideas as to which should be adopted.

In designing a pier the method of procedure may be as follows:

First, there should be a personal inspection and study of the location, then an examination of existing maps, including those of the Federal government, of the county and city, obtaining full information as to the water currents and prevailing winds, the water elevations above and below mean low water, the types of ships which will use the terminal, possible rail connections—in short, a complete knowledge of all the local conditions; then if there are no physical limitations, the length of the piers is to be determined.

Length of Pier

The width of the piers and the width of the slips depend upon the length of the piers as well as the carrying capacity of the ships, and hence this length must first be

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planned. The longer the pier the wider the pier and the wider the slip, and while there is a certain width of pier and slip for a pier of one unit in length, for a two-unit pier both pier and slip should be wider.

As in the design of the quay unit, there is a pier unit. The pier unit complete consists of the pier, the length of which is made equal to the length of the largest freighter that may there berth or a multiple of that length, sheds, railway tracks and mechanical appliances.

A pier may be of several units in length. The limit of the length of piers is generally the pierhead line of the Federal government. Longer piers can be obtained by designing the piers at an oblique angle to the bulkhead than at right angles.

If, for example, the length of the longest freighter to be there berthed is between 600 and 700 feet, as 625 feet, it is reasonable to suppose that there will be an increase to 700 feet, and therefore 700 feet may be taken as the length of the pier unit. If there should in the future be an increase in length beyond 700 feet, then the pier can be lengthened. It is, however, not advisable to build the unit length of any pier much longer than the probable length of the ship that may be built within some twenty-five years and will use the pier.

For two units the length should be 1,400 feet, or twice 700 feet.

WIDTH OF SLIP

If the pier should be 700 feet in length, then the width of the slip should be from 280 feet to 300 feet. If the pier be 1,400 feet long, then the width of the slip should be from 325 to 350 feet. If the pier be one unit length, the width of the slip should be four times the beam of the widest freighter that may there berth. As 70 feet, as above, may probably be this width, the slip width has been given as 280 feet to 300 feet, as follows: (25 feet width of barge, 70 feet width of ship, 25 feet width of second barge) $\times$ 2 = 240 + 40 feet for working space.

If the pier be of two units in length, then the width should be from 325 feet to 350 feet, or about five times the width of the widest freighter. This is divided up as follows:

From pier to ship, 25 feet, this allowance being for barges, then 70 feet, the width of the ship, then 25 feet for a barge or lighter on the outside of the ship, then 85 feet for passageway of a ship from the inner berth; this would make (25 + 70 + 25) $\times$ 2 + 85 = 325 feet. Barges may be wider than 25 feet, so 350 may be taken as the maximum and 325 feet as the minimum

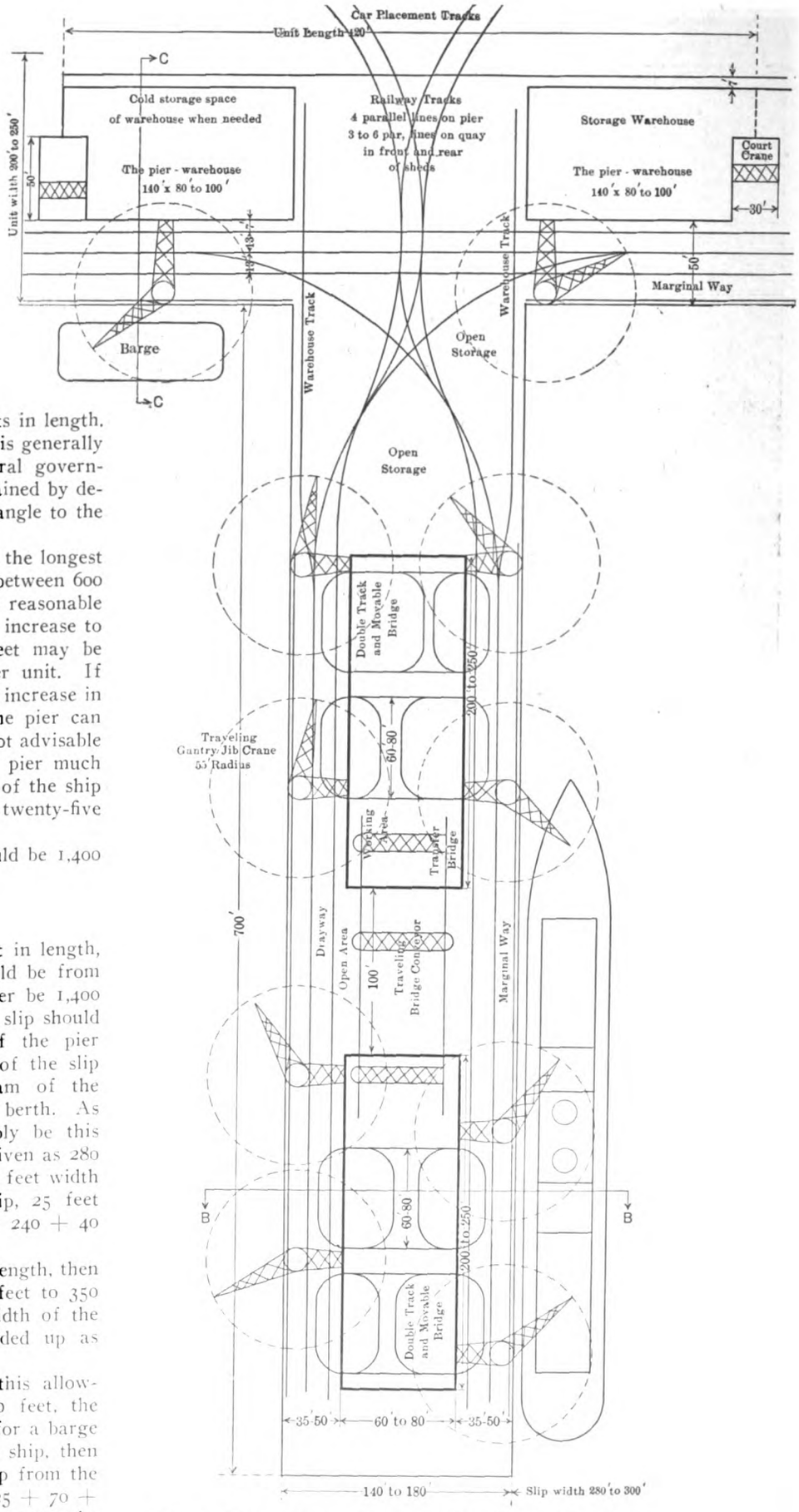

Fig. 2.—Pier Unit Comprising One Pier with Two Warehouses, Two Sheds and Mechanical Appliances for Handling Miscellaneous Cargo

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width. The barges may average 100 feet in length; there may therefore be seven barges alongside one ship lengthwise. If there be four ships, the number of barges alongside of four ships would be twenty-eight barges.

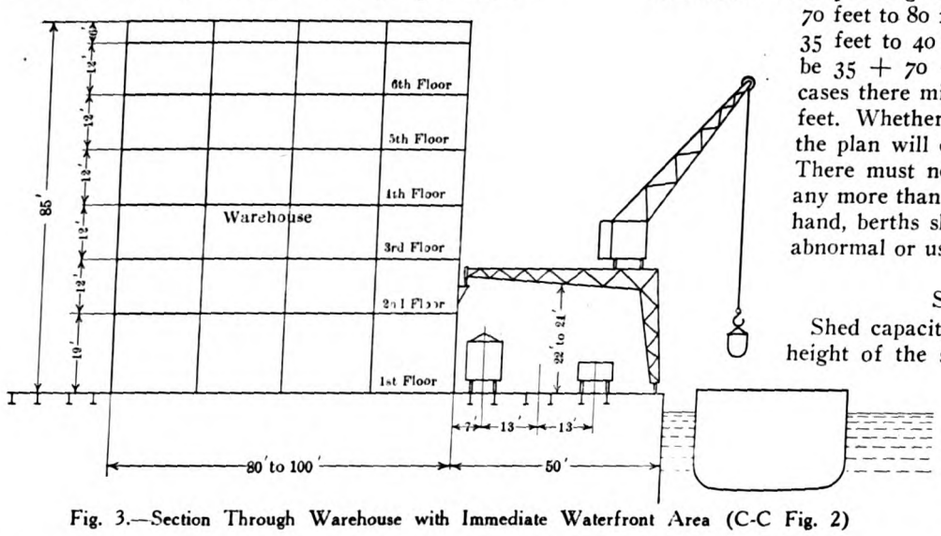

Fig. 3.—Section Through Warehouse with Immediate Waterfront Area (C-C Fig. 2)

It should be possible for the inner barges to move out without moving the other barges which are being discharged or loaded.

The figure of 280 feet to 300 feet as the width of the slip is correct, and will provide berths for many years to come under the assumed conditions. Congestion in the slips should be avoided when possible, although often there are many barges waiting. It is not deemed advisable to make the slips wider on this account.

Width of Pier

The width of the pier should provide for railway coordination on each side of the pier and a shed capacity for holding the cargoes of two inbound ships. Outbound cargoes often must be held in the shed for a short time.

For the single unit pier of a length of 700 feet up to 1,000 feet, the width may be 140 feet to 150 feet, divided as follows: From pier edge to shed 35 feet to 40 feet, shed 70 feet to 80 feet, on the other side of shed, 35 feet to 40 feet. Therefore there would be 35 + 70 + 35 = 140 feet. In some cases there might be 40 + 80 + 40 = 160 feet. Whether maximum or minimum width, the plan will depend upon local conditions. There must not be congestion on the pier any more than in the slip; but, on the other hand, berths should not be sacrificed by an abnormal or useless width of pier or slip.

Shed Capacity

Shed capacity is obtained by making the height of the shed below the roof trusses about 30 to 35 feet. This shed has a greater capacity than a two-story shed of equal height. It is in effect equivalent in capacity to a two-story shed, but at about one-half the cost.

On this pier unit 700 feet long, 140 feet to 160 feet wide, there are two sheds each 200 feet long, 70 feet to 80 feet wide and 30 feet to 35 feet clear height below the girders, or 200 feet by 70 feet by 30 feet, giving 420,000 cubic feet capacity. At 80 feet width the capacity would be 480,000 cubic feet per shed; for two sheds, the capacity either 840,000 or 960,000 cubic feet. This represents the gross shed capacity. There are, however, open areas as follows:

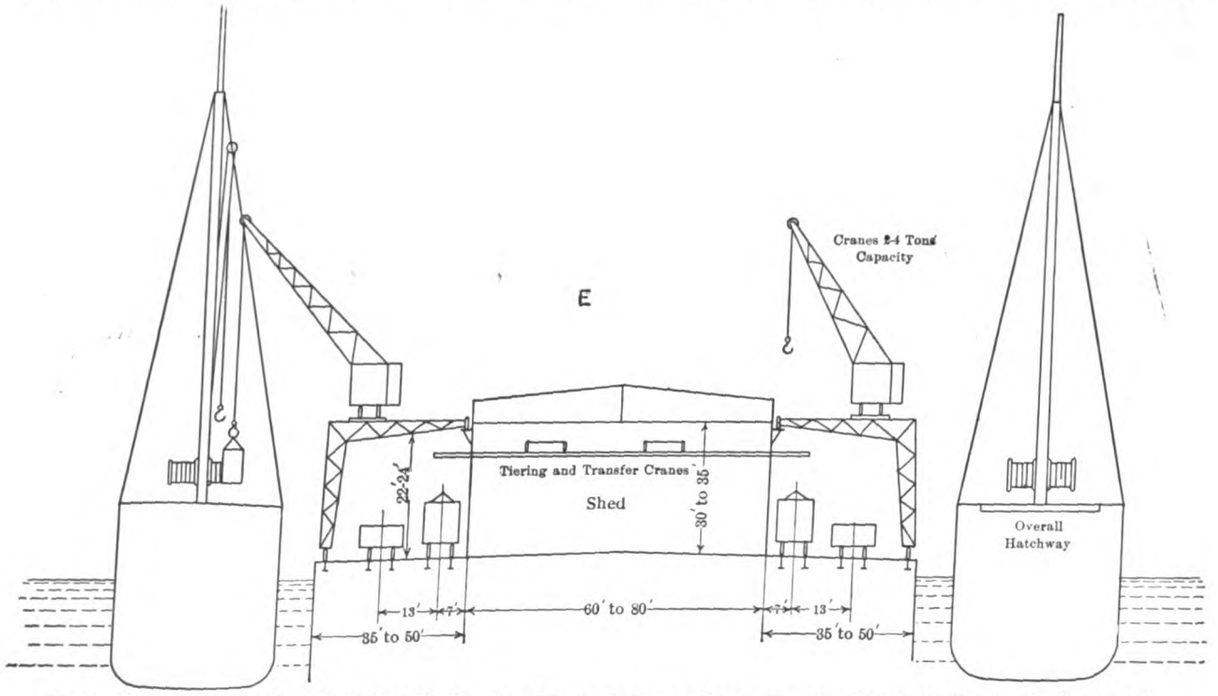

Fig. 4.—Cross Section of Pier (B-B, Fig. 2) Showing Half Arch Gantry Cranes, Transfer Shed with Tiering Machinery and Location of Railroad Tracks

Open Areas

It is not advisable to reserve space between the line of the shed and the face of the pier wall for storage, as this should be for the railway tracks and drayways.

There are, however, on a pier of a length of 700 feet,

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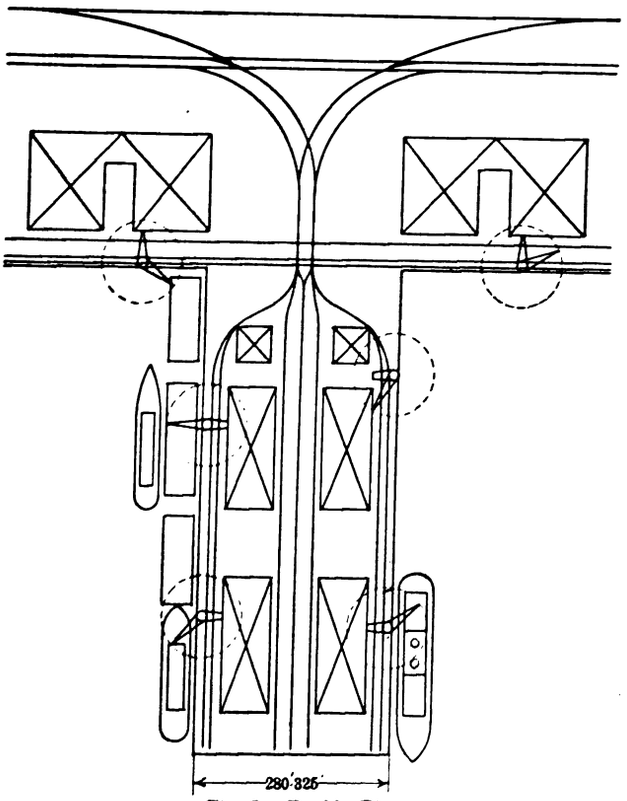

Fig. 5.—Double Pier

an open area at the end of about 70 feet by 50 feet, or 3,500 square feet, and between two sheds 70 feet by 100 feet, or 7,000 square feet, and shoreward from the second shed a net area of about 14,000 square feet, making a total of about 24,000 square feet, or about 367,500 cubic feet, tiering fifteen feet in height. This is outside of, and in addition to, the shed capacity.

There is, therefore, over 1,300,000 cubic feet, which is equal to the net cubic capacity of two ships, one on each side of the pier. Making allowances for the freight which is transferred over the side of the ship upon lighters, that which is removed as unloaded by railway cars, drays and vessels, it will be seen that there is sufficient capacity for the forty-eight to seventy-two hours' holding time. During and after this time the cargo is transferred from the shed to the warehouse.

Warehouses

The number of the warehouses can be increased, being located on the lands to the rear of the waterfront. The immediate waterfront or the shed location is limited, but there is generally ample space in the rear for many warehouses.

If the pier should be 1,000 feet in length, then there would be one additional shed and 100 feet additional open area.

Mechanical Appliances

As to the mechanical appliances, those outside of the shed should be universal in character and should be able to transfer all the varied kinds of freight which must be unloaded and loaded at a public terminal.

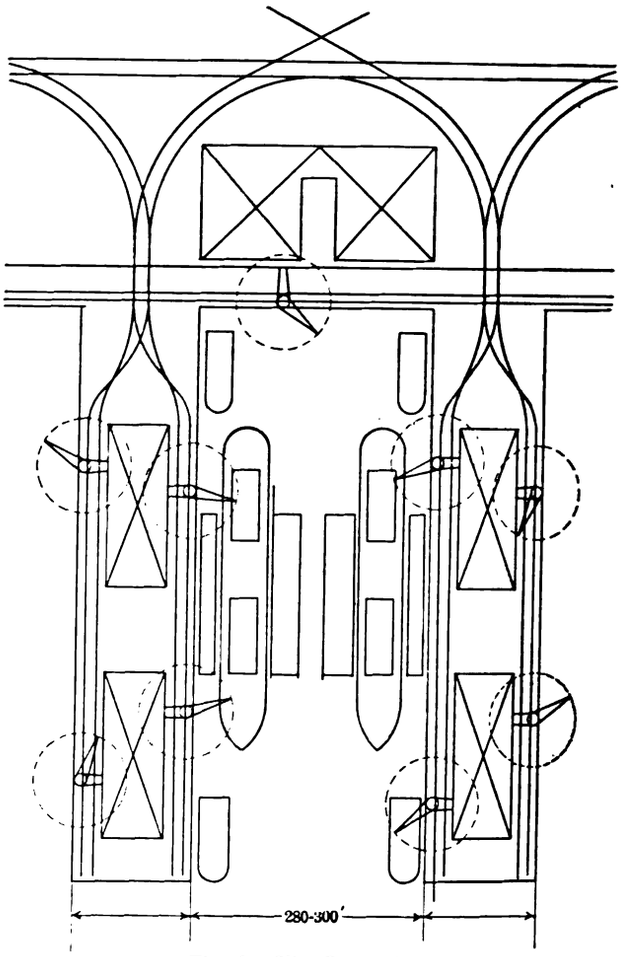

Fig. 6.—Slip Occupation

The traveling gantry jib crane fulfils all the requirements and is generally the type installed. It can serve a larger area without congestion than any other type of unloading or loading machinery, and will be found at most ports where modern machinery is installed. There are over twenty companies in the United States who manufacture and sell these cranes.

Such a crane should have a lifting capacity of 2-4 tons, that is, two tons at 200 feet to 300 feet per minute with one rope, and four tons at one-half this speed. There should be temporary excess capacity of fifty percent. The rotary speed should be from two to three revolutions per minute, and the traveling speed from 200 to

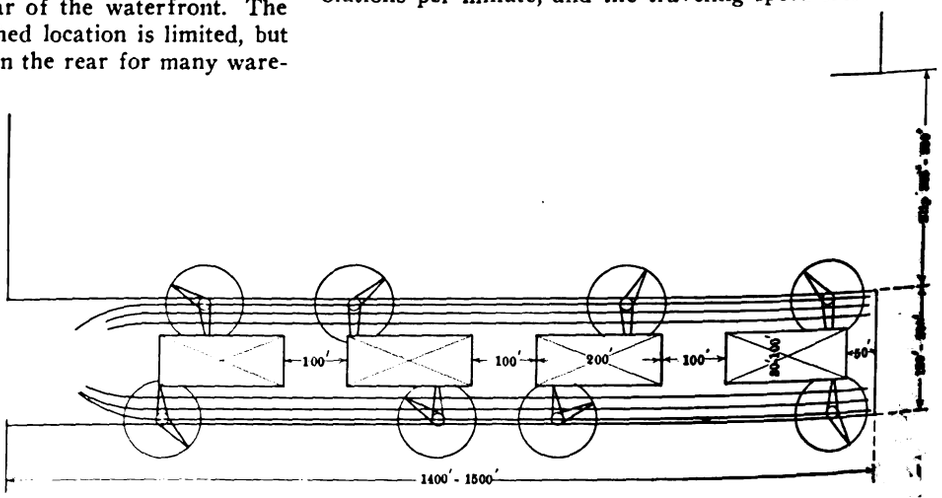

Fig. 7.—Two-Unit Pier

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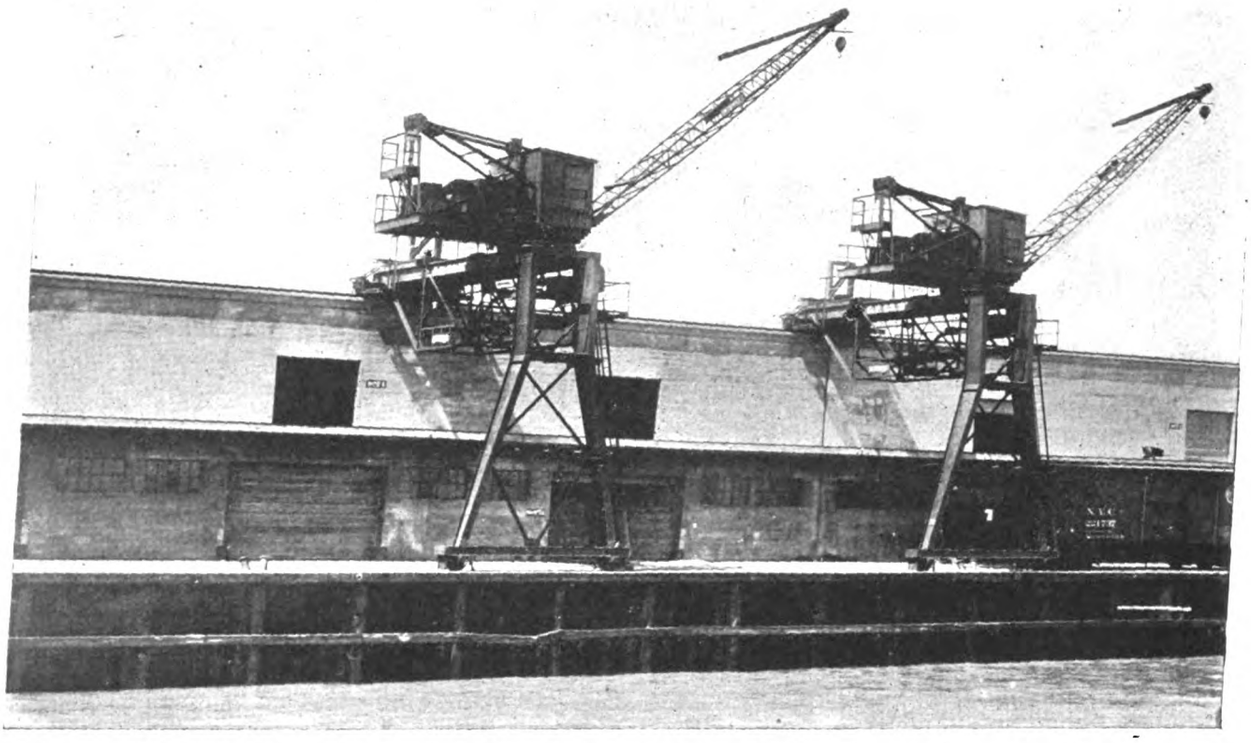

Fig. 8.—Side View of Pier, Showing Shed, Traveling Gantry Jib Cranes and Location of Railway Tracks Between Shed and Side of Pier

300 feet per minute. Two such cranes operating at each hatch, in conjunction with the winches on the ship, will enable wonderful speed of discharging to be attained. The weight of such a crane would be about 50,000 pounds.

To avoid floor congestion in the shed, there should be overhead traveling cranes for assorting, distributing and

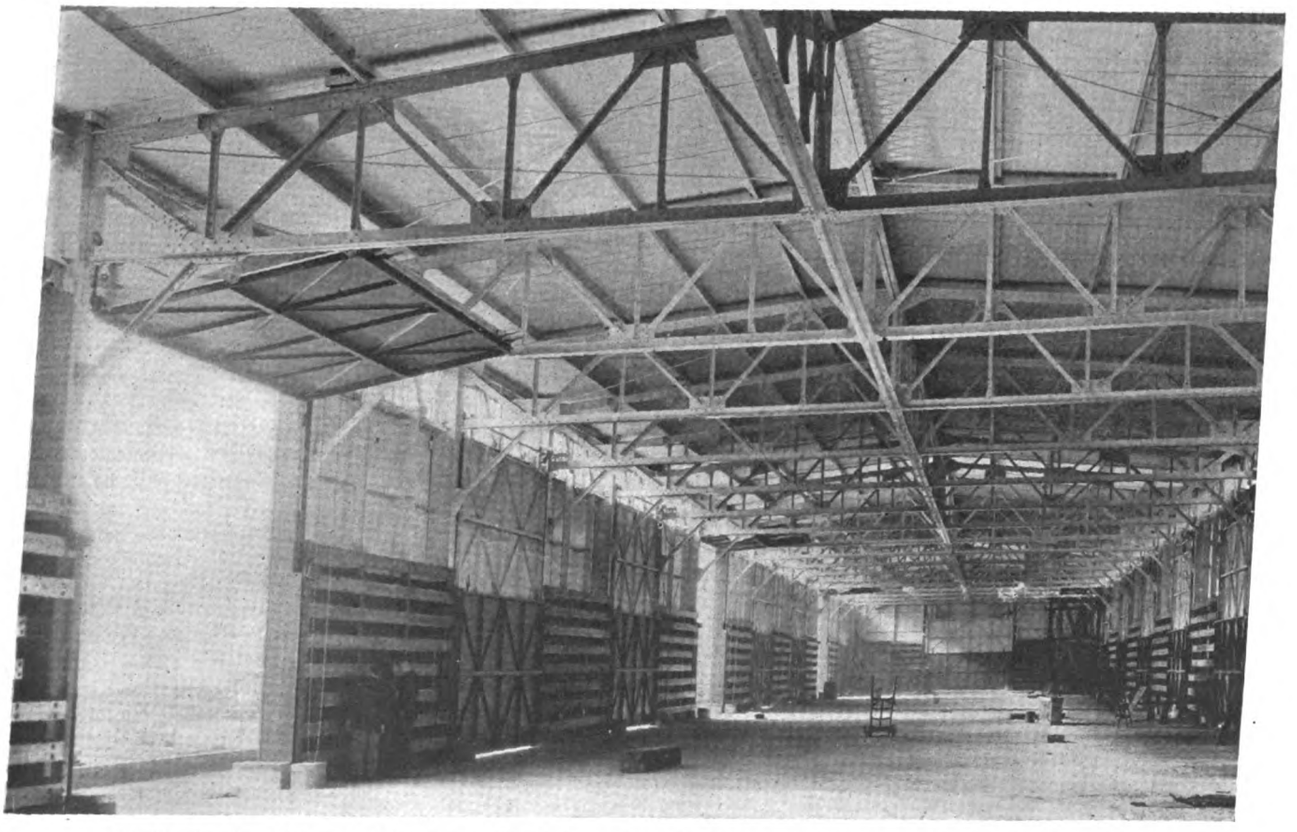

Fig. 9.—Interior of Pier Shed Showing Details of Construction, Methods of Framing and Side Protecting Planking

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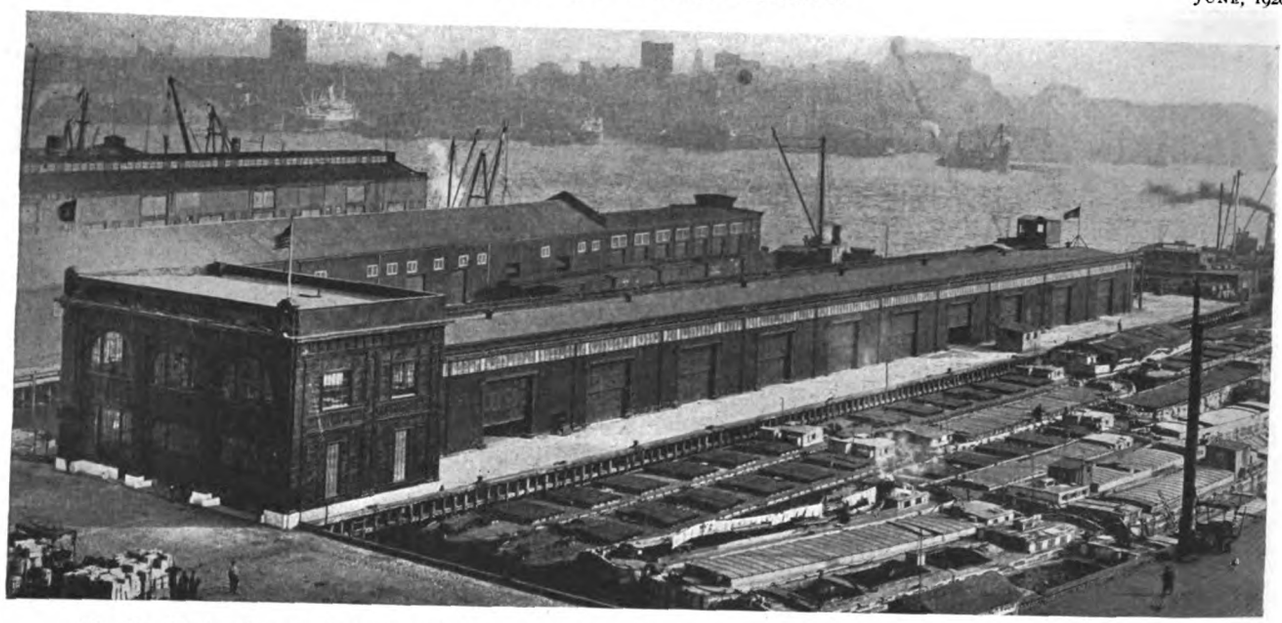

Fig. 10.—Typical Pier Shed Showing Headhouse for Offices, Side Doors and Dray Area Alongside of Shed to Be Spanned by Traveling Gantry Jib Cranes

tiering. The general arrangement of this machinery is indicated in the attached plan and elevation. It will be noticed that provision is here made for transferring freight across the pier.

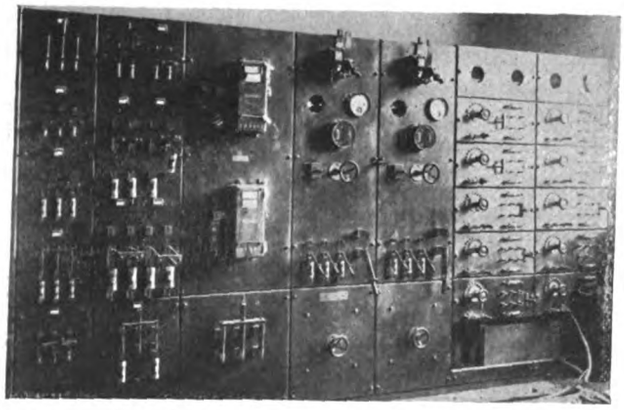

Fig. 11.—Switchboard for Modern Pier Shed. This Board Controls the Lighting of the Shed, the Operations of the Various Gantry Cranes and the Charging of Storage Batteries

CONCLUSIONS

First—Single unit piers about 700 feet long should be 140 to 150 feet wide, with slips 280 feet to 300 feet wide.

Second—Sheds should have large capacity due to high tiering by overhead machinery.

Third—Traveling gantry jib cranes adapted to lifting and swinging miscellaneous cargoes should be installed.

Fourth—Railway tracks should be installed on both sides of the piers, and provision made for drayways.

BRITISH OIL BUNKERING STATIONS.—The rapid conversion of British and American shipping to oil fuel has created a new problem of how to keep these ships supplied with bunkers. Here is the British answer to the problem. A large British oil bunkering company, backed by powerful interests, is being formed to supply fuel to oil-burning ships at bunkering stations throughout the world. The chairman of the new company will be Lord Inchcape, who is a director of the Anglo-Persian Oil Company. Messrs. William Cory and Son, Ltd., will act as selling agents and will be in a favorable position to prepare for the supply of oil fuel to ships at stations throughout the world, through its own organization and the arrangements of the coaling firms it controls. While the rduction in the price of British bunker coal has brought a certain amount of relief to shippers, the problem of securing a sufficient supply of oil fuel for British ships has become acute and is likely to become more so as vessels fitted for burning oil fuel leave the builders' yards in increasing numbers. The new British company is said to be assured of supplies of oil in the East and will no doubt be able to strengthen its position in other directions.

Material Handling Machinery at the New York Electrical Show

PRACTICALLY every type of machine used in handling freight shipments at the steamship piers and railroad terminals will be exhibited at the Electrical Exposition to be held at the Grand Central Palace, New York, in October. These exhibits which are to be a special feature of the show will be presented and demonstrated under the auspices of the Material Handling Machinery Manufacturers' Association, which has spared no pains or trouble in making this big industrial exhibit comprehensive to the last detail. In order to have sufficient room to demonstrate properly small trucks, portable cranes, trailers and so forth, the whole third floor will be given over to this purpose.

This will be the first time that the Electrical Show has specialized to any degree in one particular branch of electrical machinery. Economic conditions in the country, though gradually improving, are still far from their prewar standards, and it is in a measure to help better these conditions through the more general use of electrical industrial machinery that this new policy of the Electrical Show Company has been adopted. Hotel, home and office appliances are to retain the same prominent positions they have always held at the show and they will be featured in the same manner this year as in previous years. The advent of larger machinery will in no way curtail their prominence.

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Provisions of the Jones Shipping Bill

After months of hearings and discussion, the United States Senate has passed, on May 21, the shipping bill reported by the Committee on Commerce, of which Senator Jones of Washington is chairman. The bill, as passed by the Senate, was substantially the same as reported out of the committee, the main features of which are outlined in this article. The bill is now in conference with the House members, and it is hoped that early agreement will be reached so that the bill may become a law before the recess of Congress.

THE Jones shipping bill, as reported to the United States Senate by its Committee on Commerce, provides for the promotion and maintenance of the American merchant marine, repeals certain emergency legislation and provides for the disposition, regulation and use of property required thereunder and for other purposes. The purpose of the bill is clearly indicated in the preamble, which reads as follows:

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it is necessary for the national defense and for the proper growth of its foreign and domestic commerce that the United States shall have a merchant marine of the best equipped and most suitable types of vessels sufficient to carry the greater portion of its commerce and serve as a naval or military auxiliary in time of war or national emergency, ultimately to be owned and operated privately by citizens of the United States; and it is hereby declared to be the policy of the United States to do whatever may be necessary to develop and encourage the maintenance of such a merchant marine, and, insofar as may not be inconsistent with the express provisions of this Act, the United States Shipping Board shall in the disposition of vessels and shipping property as hereinafter provided, in the making of rules and regulations, and in the administration of the shipping laws keep always in view this purpose and object as the primary end to be attained."

Shipping Board to Be Enlarged

The bill provides for a Shipping Board composed of seven commissioners instead of five as at present, the commissioners to be appointed by the President by and with the consent and advice of the Senate, two for a term of one year and the remaining five for terms of two, three, four, five and six years respectively from the date of their appointment. Their successors will be appointed for terms of six years. Two of the commissioners will be appointed from the states touching the Pacific ocean, two from states touching the Atlantic ocean, one from the states touching the Gulf of Mexico, one from the states touching the Great Lakes, and one from the interior, but not more than one shall be appointed from the same state. The salary of the members of the Board is fixed at $12,000 per annum.

Sale of Government-Owned Vessels

Provisions for the sale of merchant vessels owned by the Government are contained in section 5, from which the following is taken:

"That to accomplish the declared purposes of this Act, and to carry out the policy declared in section 1 hereof, the board is authorized and directed to sell, as soon as practicable, consistent with good business methods and the objects and purposes to be attained by this Act, to persons who are citizens of the United States except as provided in section 6 of this Act, all of the vessels referred to in section 4 of this Act or otherwise acquired by the Board. Such sale shall be made at prices and on terms and conditions as the board may prescribe, but the completion of the payment of the purchase price and interest shall not be deferred more than twenty years after the making of the contract of sale. The board in fixing or accepting the sale price of such vessels shall take into consideration the prevailing domestic and foreign market price of, the available supply of, and the demand for vessels, freights received and prospects of their maintenance, the cost of constructing vessels of similar types under prevailing conditions, as well as the cost of the construction or purchase price of the vessels to be sold, and any other facts or conditions that would influence a prudent, solvent business man in the sale of similar vessels or property which he is not forced to sell; Provided that no sale shall be made at a less price than the cost at the time of making such sale of constructing vessels of similar types in private yards in the United States, after deducting the depreciation charge against the vessels sold generally allowed in shipping operations."

In the following section the Shipping Board is authorized and empowered, if unable to sell to American citizens after diligent effort to do so, to sell to aliens at such prices and on such terms and conditions as it may determine, except that payment thereafter shall be completed in ten years, such vessels having a deadweight tonnage of not exceeding 6,000 tons, unless such vessels are over ten years of age, as it shall after careful investigation deem unnecessary to the promotion and maintenance of an efficient American merchant marine.

Steamship Lines to Be Established

Section 7 gives the Shipping Board authority to investigate and determine what steamship lines should be established and to put in operation from ports in the United States, or in any territory, district or possession thereto, where adequate terminal connections with rail carriers can and will be made or already exist to such world markets as in the judgment of the Shipping Board are desirable for the promotion, development, expansion and maintenance of the foreign and coastwise trade of the United States and an adequate postal service.

The Board is also authorized to determine the type, size, speed and other requirements of the vessels to be employed upon such lines and the frequency and regularity of their sailings, with a view to furnishing adequate, regular, certain and permanent service. The Board is authorized to sell, and, if a satisfactory sale cannot be made, to charter such vessels of the United States as will meet these requirements, to responsible persons who are citizens of the United States who agree to establish and maintain such lines upon such terms of payment and other conditions as the Board may deem just and necessary to secure and maintain the service desired. If privately operated steamship lines cannot be established in this way, the Board is authorized to operate vessels on such lines until the business is developed so that the vessels can be sold on satisfactory terms and the service maintained or until it appears within a reasonable time that such lines cannot be made self-sustaining.

In the same section authority is given to the Postmaster-General to contract for the carrying of the mails over such lines at such prices as may be agreed upon by the Board and the Postmaster-General. Preference in the sale or assignment of vessels for operation on such steamship lines will be given to persons who are citizens of the United States who have the support, financial and other-

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wise, of the domestic communities primarily interested in such lines, if the Board is satisfied of the ability of such persons to maintain the service desired. Provision is made so that the provisions of this section will not conflict with the steamship lines already established, and in the following sections of the bill are prescribed certain duties of the Shipping Board with regard to the promoting, encouraging and developing of ports and transportation facilities and for the investigation of causes of the congestion of commerce at ports and also the important question of water terminals, including the necessary docks, warehouses, apparatus, equipment and appliances in connection therewith, with a view to advising and suggesting the types most appropriate for different locations and for the most expeditious and economical transfer or interchange of passengers or property between the rail and water carriers.

SHIP CONSTRUCTION FUND CREATED

Section 11 of the bill provides for a construction fund to be created from the revenue acquired from the sales and operation of vessels by the Board. The provisions of this section are as follows:

"That during a period of five years from the enactment of this Act the board may annually set aside out of the revenues for sales and operations a sum not exceeding $50,000,000, to be known as its construction fund, to be used in the construction, or in aid of the construction, of vessels of the best and most efficient type for the establishment and maintenance of service on steamship lines deemed desirable and necessary by the board, and such vessels shall be equipped with the most modern, the most efficient, and the most economical machinery and commercial appliances. The board shall use such funds to the extent required upon such terms as the board may prescribe to aid persons, citizens of the United States, in the construction by them in private shipyards in the United States of the foregoing class of vessels. No aid shall be for a greater sum than two-thirds of the cost of vessel or vessels to be constructed, and the board shall require such security, including a first lien upon the entire interest of vessel or vessels so constructed as it shall deem necessary to insure the re-payment of such sum with interest thereon and the maintenance of the service for which such vessel or vessels are built. If there are routes upon which the board deems it highly important to establish service requiring vessels of the kind described in this section, and responsible persons, citizens of the United States, cannot be found to construct the same, the board may construct such vessels out of such fund in private shipyards of the United States, but no contract for such construction shall be let on a cost-plus basis, and when such vessels are sold the board shall require a cash payment of not less than 25 per centum of the purchase price and ample security for deferred payments. Interests on loans made under this section and on deferred payments shall be at a rate not less than 4 per centum per annum, payable semi-annually."

Until sold, all Government-owned vessels shall be managed and operated by the board or chartered or leased by the board, and provision is made for the continuance of the United States Emergency Fleet Corporation, which shall have the authority to operate such vessels. All property other than vessels which have been transferred to the board is to be sold by the board. The board may also create out of the net revenue from operations and sales, and maintain and administer, a separate insurance fund to cover any interest of the United States in vessels either constructed or in process of construction or any plants or materials required by the board.

FOREIGN BUILT VESSELS EXCLUDED FROM COASTWISE TRADE

The Jones bill repeals the war emergency act which permitted vessels of foreign registry and foreign-built vessels admitted to American registry under the Act of August 18, 1914, to engage in the coastwise trade during the war and for a period of 120 days thereafter. In repealing this Act, however, the provision is made that all foreign-built vessels admitted to the coastwise trade under such Act for the full period covered by the Act and which are wholly owned by the persons who are citizens of the United States, and foreign-built vessels owned by the United States at the time of the enactment of this Act, if sold to such persons may operate in the coastwise trade so long as they are owned by such persons.

EXEMPTION FROM EXCESS-PROFITS TAXES

Under the provisions of section 25 of the Jones bill, the owner of a vessel documented under the laws of the United States and operated in foreign trade shall, for each of the ten taxable years beginning with the first taxable year ending after the enactment of this Act, be allowed as a deduction for the purpose of ascertaining his net income subject to the war-profits and excess-profits taxes imposed by Title III, of the Revenue Act of 1918, an amount equivalent to the net earnings of such vessel during such taxable year, determined in accordance with rules and regulations to be made by the board, provided that such owner shall not be entitled to such deduction unless during such taxable year he invested, or set aside under rules and regulations to be made by the board in a trust fund for investment, in the building in shipyards of the United States of new vessels of a type and kind approved by the board, an amount to be determined by the Secretary of the Treasury and certified by him to the board equivalent to the war-profits and excess-profits taxes that would have been payable by such owner on account of the net earnings of such vessels but for the deduction allowed under the provisions of this section, or unless such owner with the approval of the board (to be given only if because of the smallness of the amount involved the board deems it best for the interests of the United States) applies such amount on any mortgage indebtedness due to the United States for the purchase of ships.

Furthermore, this section provides that during the period of ten years from the enactment of the Act any person a citizen of the United States who may sell a vessel built prior to January 1, 1914, shall be exempt from all income taxes that would be payable upon any of the proceeds of such sale, if the entire proceeds thereto shall be invested in the building of new ships in American yards, such ships to be documented under the laws of the United States and to be of a type approved by the board.

It is further provided in this section that the Secretary of the Treasury, the Secretary of Commerce and the chairman of the board are authorized and directed to determine from time to time what shall be allowed for annual depreciation of vessels purchased from the United States, or vessels completed in the United States, since November 11, 1918, in order that the owners of such vessels shall, with respect to the capital cost thereof, be put as nearly as may be on a parity with the owners of ships under the flag of our foreign competitors in the world's carrying trade, and such allowances shall be embraced in the deductions allowed by law in determining the net income subject to income taxes and war-profits and excess-profits taxes.

AMERICAN CLASSIFICATION FOR AMERICAN VESSELS

Section 27 of the bill directs all departments, boards, bureaus and commissions of the Government to recognize the American Bureau of Shipping or any other similar organization approved by the board composed of Ameri-

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can citizens, chartered in the United States and 90 percent of whose surveyors shall be American citizens, as their agency for the classification of vessels owned by the United States and for such other purposes in connection therewith as are the proper functions of a classification bureau so long as the American Bureau of Shipping or such approved organization continues to be maintained as an organization which has no capital stock and pays no dividends.

Permission is given in section 28 for cargo vessels documented under the laws of the United States to carry not more than 12 persons in addition to the crew. Such vessels are not to be held as passenger vessels or vessels carrying passengers within the meaning of the inspection laws, although this section does not in any way exempt such vessels from the laws, rules and regulations respecting life-saving equipment.

Differential Rates for Imports and Exports in American Vessels

Preferential rates for imports and exports in American vessels are made possible by the provisions of section 30, which reads as follows:

"That no common carrier shall charge, collect or receive, for transportation subject to the Interstate Commerce Act of persons or property, under any joint rate, fare or charge, or under any export, import or other proportional rate, fare or charge, which is based in whole or in part on the fact that the persons or property affected thereby is to be transported to, or has been transported from, any port in a possession or dependency of the United States, or in a foreign country, by a carrier by water in foreign commerce, any lower rate, fare or charge than that charged, collected or received by it for the transportation of persons, or of a like kind of property, for the same distance, in the same direction, and over the same route, in connection with commerce wholly within the United States, unless the vessel so transporting such persons or properties, or unless it was at the time of such transportation by water, documented under the laws of the United States and owned by persons who are citizens of the United States."

The foregoing provisions may be suspended by the Interstate Commerce Commission whenever the Shipping Board is of the opinion that adequate shipping facilities to or from any port in a possession or dependency of the United States or a foreign country are not afforded by vessels so documented and owned but such suspension of the provisions of this section are to be terminated by order of the commission whenever the board is of the opinion that adequate shipping facilities are afforded by such vessels to such ports.

The Way Open for Preferential Duties

Another highly important provision is incorporated in the Jones bill which may be of great advantage to the American merchant marine in its coming struggle to gain its share of foreign commerce. This provision is found in section 37 which reads as follows:

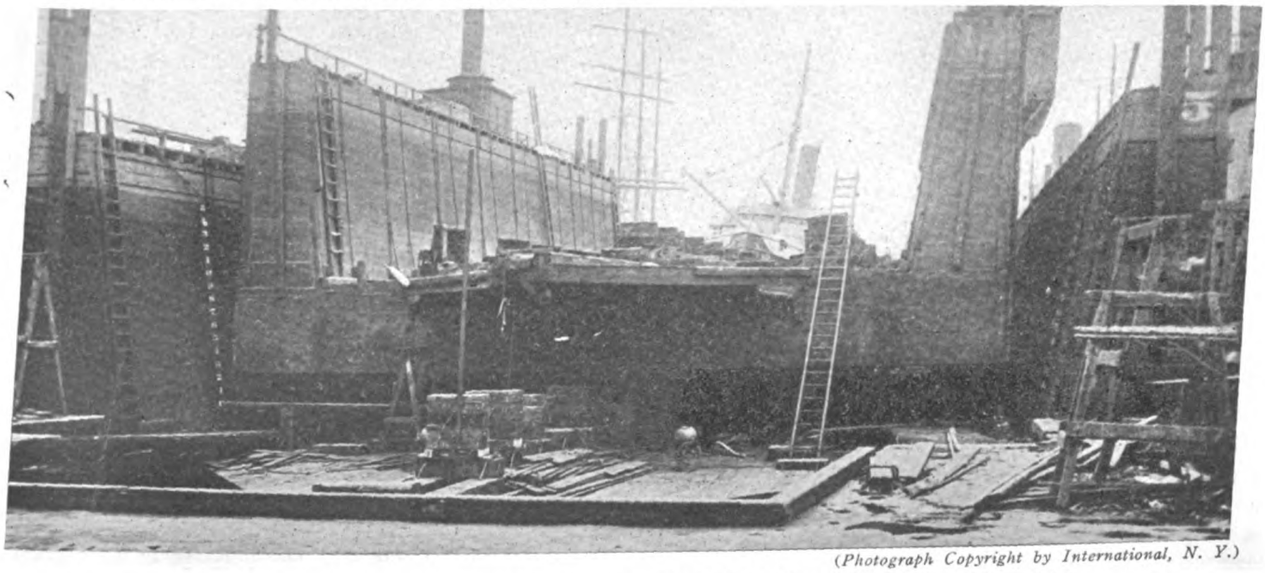
"That in the judgment of Congress, articles or provisions in treaties or conventions to which the United States is a party, which restrict the right of the United States to impose discriminating customs duties on imports entering the United States in foreign vessels and in vessels of the United States, and which also restrict the right of the United States to impose discriminatory tonnage dues on foreign vessels and on vessels of the United States entering the United States should be terminated, and the President is hereby authorized and directed within ninety days after this Act becomes law to give notice to the several Governments, respectively, parties to such treaties or conventions, that so much thereof as imposes any such restriction on the United States will terminate on the expiration of such periods as may be required for the giving of such notice by the provisions of such treaties or conventions."

Marine Insurance

Under section 31 of the Jones Bill provision is made that nothing contained in previous acts of Congress to protect trade and commerce against unlawful restraints and monopolies, or in any anti-trust laws, shall be construed as declaring to be illegal an association entered into by marine insurance companies for the following purposes only: (1) Re-insuring or otherwise distributing or dividing their risks on hulls, cargo or other interests entering into our inland, coastwise or foreign trade; and (2) transacting an insurance or re-insurance business in foreign countries, provided such association is not used in furthering unfair methods of competition against domestic competitors, or is otherwise unfairly restraining trade.

Section 32 of the bill takes up in great detail the question of mortgages on vessels and the protection of the rights of holders of vessel mortgages so that such investments will be more adequately secured. This section includes the provisions of the mortgage bill previously passed by the House.

The remainder of the bill consists chiefly of provisions relating to the rights and welfare of seamen on American vessels.



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Docking a Drydock at the Plant of the Tietjen & Lang Dry Dock & Repair Company, Hoboken, N. J.

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THE Simmons-Boardman Publishing Company is devoting its entire attention to the field of transportation, the key industry of the world. The prosperity of our country depends upon the construction, operation and maintenance of the railways and merchant marine because it is useless to produce more than its arteries can handle. The present congestion at the seaports, railway terminals and junctions, and the resultant strain on our none-too-plentiful supply of foodstuffs and merchandise, is perhaps the most convincing argument to the average man that the transportation facilities must be enlarged and maintained.

Twenty-five editors, backed by the contributions of the best brains in the country, are constantly at work on our five magazines and four cyclopedias, which cover the railway field. The railways, however, important as they are to our national life, cannot carry our products to foreign shores—that must be done by ships. The construction of our merchant marine—America's greatest industrial achievement of the war—which is only thoroughly appreciated by foreign countries, must go on. If Congress passes the proper legislation, the problem of competition with other countries, both in construction and operation, can and will be solved.

The first step taken by the Simmons-Boardman Publishing Company to aid the construction of the American merchant marine was the compilation of a *Shipbuilding Cyclopedia* which has just been completed. The second step was the purchase of MARINE ENGINEERING which was only consummated after the most careful analysis had shown it to be the best magazine in the marine field. It would indeed be hazardous for a firm of less resources to promise an improvement in such a magazine, but it is believed that, by combining the editorial staff of the *Shipbuilding Cyclopedia* with the existing staff of MARINE ENGINEERING, this object can be accomplished. MARINE ENGINEERING has been very fortunate in securing a contributing staff that is so well known that it needs no introduction to the marine field. Every effort will be made to induce our contributors in America to become more active, and in order that MARINE ENGINEERING may be made more international in scope, special attention will be given articles received from our correspondents in Great Britain covering the shipbuilding industry in that country.

Production and Planning

AS the idea of establishing a central planning office with complete control over the entire plant is gradually gaining favor with the shipyards, and as the success of this method of supervision depends upon the system adopted for carrying it out, it must constantly be borne in mind that the principal duty of the planning department is to devise and put into operation a means for reducing the cost of production. It follows therefore that the principal reason for a planning department being one of economy, the criterion of the success or failure of this department is the amount of money it is actually saving.

The tendency of those in charge of work of this nature is, very often, to go too far into detail. Where such is the case, the planning department, instead of speeding up the work, retards it. In any system the paper work involved is expensive, and in order to eliminate this work as much as possible, the system must be simple. Every operation of the system should be carefully analyzed and should, before being adopted, show some value from a practical standpoint. There are many lines of work in a modern shipyard which could be investigated and which would provide some very interesting data from a technical point of view, but with competition becoming sharper, the shipbuilder cannot afford the time or money which necessarily enter into this work.

On page 499 of this issue appears an article by Donald G. Stevens, under the title of "Why is a Progress and Planning Department?", which gives a general outline of the planning department as operated at the Virginia Shipbuilding Corporation. While Mr. Stevens outlines more or less clearly the methods he uses for keeping track of the progress of work, he omits mentioning the methods used for planning and following up the work, ordering and handling material, compiling cost data, etc. It would appear from the aforementioned article that charting the progress of work constituted the chief function of a planning department where, as a matter of fact, the planning is of greater importance because it directly affects the production. By planning the work in detail in advance and by properly following it up through the various shops in the yard until it is completed and installed aboard ship, the planning department is able to co-ordinate the work of the various trades and departments with a view to eliminating lost motion and unnecessary handling. A few well-chosen charts are important and desirable, but it would appear that the number mentioned in Mr. Stevens' article is excessive. The collection, preparation and charting of data is expensive and should be reduced to a minimum.

Production and planning work is a subject of interest to shipbuilders at any time, but particularly the present, and MARINE ENGINEERING would be glad to receive articles from those in other yards interested in the success of this method of management.

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Location of Machinery

THE fore and aft position of the propelling machinery in a vessel is generally located amidships in ocean practice and aft in Great Lakes practice. The question, however, of where the machinery should be located is not determined by the locality in which the vessel is constructed, but rather by the class of service for which the ship is designed. Naval architects, as a rule, are fully aware of the advantages and disadvantages of the two systems of machinery installation and they do not hesitate to place the machinery aft in the case of oil tankers and colliers that are designed for service on the Atlantic Ocean.

Where the machinery is located aft it follows, with few exceptions, that the propeller will always remain immersed, no matter what the condition of loading of the vessel may be, but it will be found necessary, when the ship is sailing light, to carry a large quantity of ballast well forward for the purpose of keeping the bow down. On the other hand, with the machinery located amidship, the variation in trim under the various conditions of loading will be slight and much more satisfactory sailing qualities in a seaway are to be expected.

The weight of the machinery when located aft will be less because of the reduction in length of the shafting and shaft alley. The number of shaft bearings and supports will be reduced and the problems connected with alinement, etc., will be simplified. Although the weight of the machinery is reduced, the bending moment in the structure of the vessel in hogging condition, particularly when the vessel is light, will be much greater than with the machinery amidships in which a more symmetrical arrangement of weights is secured.

Preferential Export and Import Rates to American Merchant Vessels

THE Jones Bill, which is now under consideration by Congress and which will probably be passed with few modifications, contains, in section 30, constructive legislation of the greatest importance to the successful operation of our merchant marine. Under the provisions of this section the railroads can give export and import rates only to merchandise transported over their lines which is either exported or imported in American-owned vessels. As an example of what this would mean to American shipping engaged in Oriental trades from the Pacific Coast, Mr. R. A. Dean, general counsel of the Shipping Board, in a memorandum to Senator Jones, states that the domestic rate to the Pacific Coast on steel is 61.25 against an export rae of 60 cents per hundred pounds. Under section 30 of the Jones Bill, an American-owned ship leaving the West Coast, and carrying a cargo of steel, would have a differential in its favor against a foreign competitor of $14.50 per long ton. While the amount of the differential will vary with the commodity and the length of the haul, it will go a long way toward offsetting any operating advantages enjoyed by our competitors.

Under the present law the railways can make lower rates on merchandise for export or imports whether carried in American or foreign ships but in providing that these lower rates can be given only, except under certain conditions, to goods exported or imported in American ships, we are simply following a practice that other countries have found to be greatly to their advantage. It is believed that it was by such measures that Germany before the war was able to guarantee sixty percent of her exports and fifty percent of her imports to German vessels. In a like manner Japan was able to prevent American trans-continental railroads from operating their own ships across the Pacific in competition with Japanese vessels.

These preferential rates are not discriminating duties on exports or imports, such as are prohibited in some of our treaties with foreign nations. We may not, for instance, impose a heavier duty on merchandise consigned to one of our ports because it is carried in a foreign rather than an American ship from the country with which we have the treaty. When, however, a vessel belonging to a country with whom we have a favored nation treaty carries a cargo from a country with whom we have not, as, for instance, a cargo from some of the South-American countries to New York, in an English vessel, we can, but do not, impose a preferential duty.

In view of the fact that it is necessary to put our merchant marine on a paying, as well as patriotic basis, the preferential export and import rates section of the Jones Bill should be passed as it is. Should other countries discriminate against us in a similar manner, we would still have the advantage because our average rail haul is so much greater than that in any foreign country.

Load Line

THE Load Line Bill, which is now before Congress, authorizes the Secretary of Commerce to establish by regulations, from time to time, the load waterlines and marks thereof, indicating the maximum depth to which a vessel may safely be loaded. It further directs that the Secretary of Commerce shall appoint the American Bureau of Shipping, or such other corporation or association for the survey or register of shipping as he may select, to determine whether the position and manner of marking of such vessels on the load lines are in accordance with the regulations.

Load lines on vessels as now established by the classification societies are based upon rules approved by the English Board of Trade, under the provisions of the Merchant Shipping Act of 1894. These rules require that the freeboard, or height of the side of a ship above the waterline amidships, shall be sufficient to obtain the reserve buoyancy given in their tables. As the safety of a ship depends on its subdivision transversely by the proper number of watertight bulkheads, as well as on its freeboard, the recommendations of the London Convention for the Safety of Ships at Sea should be given serious consideration in establishing new rules for load waterlines.

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LETTERS TO THE EDITOR

Efficiency in Pumping Out a Vessel

Often after a ship is launched the tanks are filled with water for the sake of testing. This water must later be voided from the ship. For this a pump is generally used, which is set near the water to be pumped. The water is forced by this through a hose which runs up through the hatches and over the side. Commonly, the discharge hose is allowed to hang over the side two or three feet and the water falls twenty or thirty feet.

This, to my mind, is a very inefficient method. It does not take much knowledge of hydraulics to see that if the outlet hose be allowed to reach the water level, the head being pumped against is reduced twenty or thirty feet or more, according to the depth of the ship. The saving in power and time by lengthening out the hose would be quite appreciable for an entire ship.

Since every American shipbuilder is endeavoring to economize in every way, I think that this matter should not escape notice.

Groton, Conn. A SHIPWRIGHT.

Sea Captain Signals Rescuers with Flashlight

Captain Albert B. Randall, master of the U. S. Transport *Powhatan*, which was disabled in a severe storm 200 miles off Halifax, reports that without the electric hand flashlights, which he carried as a part of his equipment, the work of relieving the condition of his vessel after the rescue ships arrived would have been immeasurably more difficult than it was.

The dynamos were put out of commission when the fireroom was flooded, and in consequence the lighting system was useless. There was only enough current from storage batteries to use the wireless for emergency, and when relief came and there was great necessity for communication with the ships, Captain Randall turned in the emergency to the store of electric flashlights that he carried.

He flashed messages in the Morse code and received replies in the same manner. His officers, who were also equipped with pocket flashlights, not only kept up constant communication but were able to find their way about the ship without difficulty.

New York. E. F. ALLEN.

Welding Copper by the Oxy-Acetylene Process

In an article in the November, 1919, issue by Commander H. G. Knox, U. S. N., on the "Use of Acetylene in Navy Yards," it was stated that among other metals, copper was also successfully welded by the oxy-acetylene process, rolled naval brass having been the favorite filling material, with most of the other brasses and bronzes. This led the author to make the prediction that with intelligent operation the welding of copper may some day almost completely supplant the coppersmiths' art of brazing. But the fact is that copper welded with rolled naval brass as filling material is not welded at all, but *brazed*, and badly brazed at that, as the brittle brass filling does not allow any extensive working of the metal.

At present the welding of copper is not practical, copper being so great a conductor of heat that the piece to be welded would have to be kept on a forge or other suitable apparatus for preheating at a temperature of approximately 1,100 degrees F. while the welding was going on, the process therefore being very costly.

It is of absolutely no use to attempt the extensive welding of copper unless a filling material of at least 95 percent copper content can be used. Properly preheated and kept hot and properly welded, the seam will stand some working; but up to the present time no filling material has been found which will permit the seam to be worked the same as the rest of the material. However, the oxy-acetylene process is very useful to the coppersmith, as many small flanges, branches, bosses and seams can be *brazed* economically in this manner.

Bridgeport, Conn. ARTHUR J. ROSEN,
Coppersmith, The Lake Torpedo Boat Company.

Wooden Sectional Floating Dry Docks

It is with considerable interest that I have read the comment made by Mr. J. Stuart Crandall, of the Crandall Engineering Company, on the article "Wooden Sectional Floating Dry Docks" published in the March issue of MARINE ENGINEERING.

From the second paragraph of the comment I would assume that Mr. Crandall takes exception to the statement under the heading "Design and Construction" that "the members of the sections are largely determined empirically and from good practice." Mr. Crandall states that "such design usually results in the size of the members being entirely out of proportion to the stresses they are to carry. Frequently these members are much larger than required, and at the same time the joints and connections so proportioned that they can only develop a fraction of the strength of these timbers." It is agreed with Mr. Crandall that the forces acting on a floating dock are most definite and include the weight of the ship on the keel and bilge blocks, the weight of the dock itself and the upward pressure of the water on the bottom of the dock. For good design, stress diagrams should be drawn up taking these known forces into consideration and the stresses to which each member will be subjected calculated.

Contrary to Mr. Crandall, I am of the opinion that the stresses calculated from the stress diagram for each member cannot be determined with sufficient accuracy to be solely depended upon in the design of these members. The stresses calculated for each member should be used as a guide in proportioning such members, and it will be found that in many cases the size of the member will be governed by the material required to obtain fastenings of sufficient strength. Then, again, the strength of the fastenings can only be approximately determined; so it will be seen that a wooden dry dock designed in accordance with the statement, "The members of the sections are determined largely empirically and from good practice," will result in a dock having ample strength and longevity without any unnecessary weight. This method of proportioning the members has been used in the design of several of the most successful sectional floating dry docks, and the advisability of such design has been borne out by the fact that years of service have failed to impair their capacity, usefulness and earning power. Time is the factor which determines whether or not a dock is properly designed.

In reply to Mr. Crandall's remark that no mention is made of the effect on the ship when being docked in a loose sectional dock due to wide variations in the rates of pumping, I would say that with proper operation the

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stresses set up in the ship when docking are no greater than those stresses which the ship experiences when in service. Only gross negligence in dry dock operation would result in causing undue stresses and distortion being set up in the vessel being docked. Mr. Crandall states that no mention is made of the longitudinal trussed sectional dock and the continuous-wing, separate pontoon dock as these types are designed to withstand longitudinal bending moment, thus taking care of irregularities of pumping and inequality of load distribution. This again is taken care of in the loose sectional dry dock by proper operation.

The loose sectional dry dock also has the commercial advantage over the longitudinally trussed and the continuous separate-wing pontoon docks, as in this type it is only necessary to operate a sufficient number of sections to accommodate the vessel being docked. With the two other types, the entire dock must be operated when docking a vessel which is smaller than its capacity. While it is desirable to have a dry dock able to accommodate the largest ships using the port, there is seldom a sufficient number of these ships to keep the dock busy. Thus it becomes necessary to dock vessels smaller than the dock's capacity between times, and it is this condition which is taken care of so economically in the loose sectional floating dry dock.

It isn't so much a question of having a dry dock capable of lifting the largest vessel using the port as it is of having a dry dock that can dock the largest number of vessels.

Hackensack Heights, N. J. CARL E. PETERSEN.

NEW BOOKS

Shipbuilding Cyclopedia

REVIEWED BY PROFESSOR C. H. PEABODY*

SHIPBUILDING CYCLOPEDIA. (A reference book covering definitions of shipbuilding terms, basic design, hull specifications, planning and estimating, ship's rigging and cargo-handling gear, tables of displacement of commodities, arrangement and working drawings of modern vessels, and a composite catalogue of marine equipment.) Edited by F. B. Webster, editor-in-chief; J. L. Bates and S. M. Phillips, associate editors, and A. H. Haag, consulting editor. Size, 8¼ inches by 11½ inches. Pages, 1,160. Folding plates, 61. Illustrations, over 5,000. New York, 1920: Simmons-Boardman Publishing Company. Price, $15, leather; $10, cloth.

A modern steel steamship has so many interrelated conditions and properties that a complete and satisfactory design can be made only after the main dimensions and proportions are known, but these dimensions and proportions are the subject matter of the design. The design of a ship has consequently two stages: first, the rapid selection of the main dimensions and proportion, and, second, the preparation of working drawings and the computation by the scientific department to demonstrate that the ship can be satisfactorily built to the assigned dimensions. The first stage consists in making an intelligent copy of existing ships with required modifications; the second process continues after the actual construction of the ship is well in hand and is often completed after the ship is completed and has had her trials.

In order that the preliminary design may proceed rapidly and confidently, the designer must have at hand codified information concerning various classes of ships. Text-books and handbooks on naval architecture and shipbuilding give such information in a general way; complete information in sufficient detail has hitherto been found only in the archives of the offices of shipbuilding companies; or for naval ships in the bureaus of construction and engineering. A naval architect who has at hand such archives covering large and varied construction with the information properly codified and arranged can design a new ship rapidly and confidently and will seldom if ever meet with disappoinment either in the completion of the design or in the performance of the ship in service.

The *Shipbuilding Cyclopedia* presents in a single volume the equivalent of the information found in the archives of the drawing offices of shipbuilding companies. It gives also certain methods for determining dimensions and proportions not hitherto published and much of the material is presented in new forms.

The material of the *Cyclopedia* is presented in six main groups:

(1) Dictionary of terms.
(2) Basic design.
(3) Hull specifications.
(4) Planning and estimating.
(5) Ship's rigging and cargo-handling gear.
(6) Ship plans.

The editor, Mr. Webster, in addition to his responsibility for the complete work, presents the first, third and sixth groups; Mr. Bates is responsible for the second, Mr. Phillips for the fourth, and Mr. Haag for the fifth.

(1) The dictionary of terms in addition to giving definitions and more or less cyclopedic information, gives references to pages in such a manner that it serves as an index to the book.

(2) The basic design by Mr. Bates adapts to merchant ships methods that have been developed in the Bureau of Construction and Repair for the design of warships. Much of that work in the Bureau was done by Mr. Bates, who presents here methods of design that are admirable for their simplicity and accuracy. The reviewer may perhaps be pardoned for going into this matter in some detail because it has excited his interest. The first step in the design of a ship is the selection of the length; a short ship is a cheap ship. At the same time consideration must be given to ease of propulsion. For this purpose Mr. Bates gives five diagrams by aid of which he selects a trial length and studies the effect of variations from that length and so selects the most desirable length for his design.

The second step is the selection of the draft for the ship; in a general way it may be said that a deep ship is a cheap ship. But the draft is likely to be limited by the service of the ship; and a small draft enables a ship to enter many harbors. Associated with the draft is the depth of the ship both as controlling the scantling necessary for strength and the freeboard required for safety. The basic method proposed facilitates the investigation of the effect of variation of draft and leads to an intelligent choice.

A matter of much importance in the design of a ship is the metacentric height. This is likely to receive scant consideration in a preliminary design, but if it be neglected until the complete scientific calculation is made, expensive and inconvenient changes may be forced on the builders to bring it within proper limits. The items entering into the metacentric height are the heights of the center of gravity and the metacenter above the top of the keel. The first depends on the construction of the ship and the arrangements of weights; it can be fairly well determined by comparison with known construction. The second depends on the form of the ship and is therefore

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geometrical and it can be located accurately for any set of ship's lines. Mr. Bates presents curves from which the height of the metacenter can be read from curves, which are published here for the first time. The metacentric height may be controlled in the preliminary design by the selection of the proper beam for the ship. Since the height of the metacenter varies with the square of the beam, a small variation will usually give complete control of the metacentric height.

There are two properties of a ship which stand out prominently, i. e., the displacement and the speed; that is, the power to carry a load and the power to arrive on time. A failure in either is at once evident and inexcusable. The usual method in a preliminary design is to make an intelligent copy of existing practise by the theory of similitude expressed in the form of the admiralty coefficient. This method may be made to yield satisfactory results, but it does not give a ready means of determining the proportions which will give the best performance. Not uncommonly an appreciable advantage may be had by moderate changes in the form of the ship; the best form is sometimes unexpected. It is for the investigation of this matter that experimental towing basins exist, but information from that source is slow and expensive. Perhaps the greatest advance in recent years is that presented by Admiral D. W. Taylor, U. S. N., in his *Power and Speed of Ships,* by aid of which the designer may make a study of the influence of form on propulsion and select the best model for his ship without awaiting the experiments on models which he may think desirable. This great work based on many series of models that have been towed in the naval basin relates primarily to warships; it can be used with facility for many merchant ships, but not for slow freighters. By modifications and extensions, Mr. Bates has adapted this work to the preliminary design of all types of ships and gives curves from which power may be read directly.

Having the main dimensions and proportions for a ship, the lines must be drawn as the basis for the complete computation as made by the scientific staff. These lines are controlled by the proportions to which they must conform. For ready construction of the sections and waterlines a series of diagrams is given based on Admiral Taylor's mathematical method as used in the Navy, but adapted for convenient use with merchant ships.

Passing over with bare mention such important subjects as the coefficient of propulsion as affected by appendage and selection of scantling and computation of strength, we will speak of the matter of freeboard, and especially of the presentation of the report of the "International Conference on Safety of Ships at Sea" of 1913.

(3) The third division of the *Cyclopedia*, by Mr. Webster, furnishes a guide for the preparation of hull specifications. The specifications are divided into groups and are indexed to facilitate reference to any and every item. This section will be found valuable in preparing estimates for bids on proposed vessels and for job orders, and especially as a basis for weight estimates.

(4) The section on planning and estimating, by Mr. Phillips, has to do with the supervision of ship construction in the yard. It deals with ordering material, planning and routing work and estimating cost. Excellent plans are given of such important yards as the Bethlehem Shipbuilding Corporation yards at Fore River, Sparrow's Point and Alameda, and the Baltimore Dry Docks and Shipbuilding Company and the Newburgh Shipyards.

(5) Mr. Haag in the fifth section deals with the very important matter of Ship's Rigging and Cargo-Handling Gear, making a strong plea for standardization as leading to good practice and economy. Methods and materials are represented clearly in detail with much information not readily attainable except by a search through makers' catalogues. There is also given a table of unit displacement of commodities forming common cargoes in merchant ships.

(6) The sixth section gives the equivalent of the information found in the ship plans of many drawing offices conveniently systematized and arranged. There are more than fifty folded plates and more than three hundred pages of illustrations and tabulated information dealing with every type of merchant ship; passenger ships, combination freight and passenger ships, freight ships, tugs and barges; for navigation of the deep seas, inland waters, Great Lakes and rivers; steamers with reciprocating engines or turbines, motorships and sailing vessels. Of a certain freighter there are given ten folded plates and a hundred pages of plates and tabulated data. Other ships are well represented, though with less profusion.

This material is arranged in two groups. The general plans of each ship are placed contiguously in the first group; in the second group the detail working drawings are placed in the order in which a ship is constructed—that is, in natural sequence.

The dictionary at the beginning of the book serves as an index to this section. The section begins with the center vertical keel, together with keel blocks and staging, and goes on with floors, tanks and inner bottom plating and stern framing; with typical and web framing; with bulkheads and shaft tunnel; engine and boiler casing; with decks and deck houses; with auxiliaries and fittings; with bilge and ballast pumping systems and sanitary systems; with smoke stack and ventilation system; with electrical and wireless systems, and with various fittings and appliances, including gyroscopic stabilizer.

The *Cyclopedia* is completed by a catalog section in which is found the only advertisements in the book—normal, sane advertisements such as a naval architect or a shipbuilder will be glad to read and from which needed information can be obtained. Information is the keyword of this section—information that is as much needed as that in the earlier sections. The matter of this section is selected from the catalogues of the various companies represented with their assistance. Proper and informing illustrations are given, but all the text is set in the same style with convenient side headings. The information is given clearly and conservatively, and therefore in a convincing manner.

Various deck fittings, steering engines and other appliances are especially interesting, and it is to be noted that the companies give, in addition to dimensions and capacities, the weights and the centers of gravity—information that is of the greatest direct importance to the naval architect, because there is a strong and almost inevitable tendency towards a rise of the center of gravity of the ship while the ship is being completed or even during service on account of adding appliances on the upper decks. Of like interest is the information concerning anchors and chains and heavy forgings, which indicates that American makers can furnish these essentials sufficient for ships of all sizes. Engines and propellers, of course, belong to the engineering side, but the naval architect is especially interested in engines and propellers that are manufactured in standard sizes. Perhaps this condition arises most notably for Diesel engines and other internal combustion engines, but much the same condition is found with reciprocating engines and turbines of medium power.

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Questions and Answers for Marine Engineers

Inquiries of General Interest Regarding Marine Engineering and Shipbuilding Will Be Answered in this Department

This department is maintained for the service of practical marine engineers, draftsmen and shipbuilders. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Elementary Propeller Design

Q. (1039).—Kindly give list of articles or books which take up propeller design in an elementary manner.

A. (1039).—As previously suggested in this column, the following are very good: "Choosing the Right Propeller," H. H. W. Keith; *Motor Boating*, June, 1911, page 35; "Propellers," by C. H. Peabody, published by John Wiley & Son. In *Rudder* for 1916, pages 460, 499 and 544, are some notes and problems on the design of propellers for motorboats by C. Desmond.

Written versus Verbal Instructions

Q. (1040).—The writer would like to know if written instruction is an efficient way to distribute work to individuals in a squad.
T. M. W.

A. (1040).—Your question is rather vague. Written instructions are proper if it is possible to lay the squad's work out previous to undertaking it. When properly written, they have the advantage of protecting the leading man from claims that the squad members did not understand their duties. If carried too far, written instructions have the tendency of lessening an individual's initiative.

Measuring Pitch of a Propeller

Q. (1041).—Will you please discuss a method of determining the pitch of a built-up propeller after it has been installed upon a ship? If it is not convenient to publish same, please advise where this information may be obtained. E. R. S.

A. (1041).—There are several methods of doing this, one having been described in this column in April, 1919, page 301. Another very simple method, that of using two plumb bobs or weights hung over opposite edges of a blade while horizontal, is described in *Practical Marine Engineering*, by Dyson, page 608.

Valve Movement by Shifting the Eccentric

Q. (1042).—If a crank shaft 15 inches diameter, with a 5-inch eccentric, is rotated on the shaft ⅛ inch, when the piston is at top or bottom dead center, what distance would it move the valve in the steam chest? (Neglect the angularity of the eccentric rod).

A. (1042).—This same question has been answered in several previous issues, the latest being February, 1919, page 114.

Testing a Condenser

Q. (1043).—On page 97 of your February issue you show, in Fig. 30, a diagram of Westinghouse LeBlanc condenser equipment. You show that the exhaust steam elbow to condenser extends far below the top line of the tubes. How could the steam side of this condenser be tested? It seems to me that the large exhaust steam elbow would have to be removed and the aperture on the condenser shell blanked off in order to get the testing water to cover the top row of the tubes. This would mean a big job every time the condenser is to be tested.
G. W. B.

A. (1043).—The writer would suggest that unless it is positively known that the condenser is leaking badly, the amount of leakage be approximated by shutting all steam off the main condenser. If the circulating pump is run, any leakage can be drawn off by the air pump and tested for salt.

With the exhaust elbow temporarily supported, the bolts in the flange connecting it to the condenser can be removed and a ⅛-inch sheet of steel can be slipped between the condenser and the exhaust elbow and bolted in place. This will serve to blank off the turbine and will not require that the exhaust elbow be taken off. The steam side of the condenser can be filled with water and tested to a pressure of about 10 pounds, preferably by means of a temporary stand pipe. With the condenser heads off, any leaky tubes or stays may be readily found. If no blank flange is used, the turbine could be filled up with fresh water; however, we strongly advise using a blank flange, as it will be unnecessary to drain the turbine carefully by the auxiliary condenser and to jack it over. Furthermore, the chance of leakage or air pockets in the turbine is very great. Care should be taken that water does not come on one side of a valve having steam on the other.

Still another method is to search for any leaks by means of a lighted candle held near all the tube mouths, the air pump being in operation and the condenser heads off.

Corrosion of Boiler Tubes

Q. (1044).—What is the reason why tubes in the watertube boilers blister and then, of course, blow out at that place? This is a common occurrence in ships fitted with watertube boilers.

My experience is as follows: Clean boilers to start with; had a leaky condenser; density went up to 1/32. After six days brought the density down to 3/64 of 1/32; tubes started to blister and blow out. I had one boiler out of four that never gave any trouble.

A. (1044).—Your case is very interesting but not new. There has been recently a number of boilers, both Scotch and watertube, which have required retubing although less than a year old. Because of war emergency conditions it is undoubtedly true that the quality of materials has not been as good as formerly, nor has the inspection been as thorough. The Navy Department has lately put through a number of tests on boiler tubes, and in a paper by W. F. Worthington states that the following agents are responsible: fatty acids, hydrochloric, galvanic action, salty water, carbonic acid, air in feed water.

The feed water especially should be watched. The writer has found cases where the heating coils leaked and drains from the coils deposited oil in the filter tank, no observation tank being fitted.

The density stated in your figures should not of itself be sufficient to cause tube trouble; if, however, coupled with non-homogenous metal in the tubes, electrolytic action might be set up. Especially is this likely to occur if the mill scale has not been removed by pickling in dilute sulphuric acid. The fact that the tubes in one boiler gave no trouble would indicate that they had received entirely different treatment.

A very interesting example of electrolytic corrosion is cited by Mr. E. I. Palmer in the *Journal of the American Society of Naval Engineers*, 1907, page 54, in which it was claimed that copper was deposited in the tubes, appearing in the pit marks. These deposits (about 3 percent copper) seemed to come from the composition blading of the main turbines, the blades showing the effect of erosion. It would be advisable to have a metallurgist compare etched sections of the faulty tubes under the microscope with those of new tubes.

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Shipbuilding and General Marine News

Contracts for New Ships — Shipyard Improvements — Engineering Projects—Improved Appliances—Personal Items

LONGEST PIERS IN THE WORLD FOR LEHIGH VALLEY R. R.

Part of Gigantic Terminal for Ocean and Rail Freight—Piers to Be 7,000 Feet Long, Giving Six Miles of Dock Space

Quickly following maritime grants by the New Jersey State Board of Commerce and Navigation, the Lehigh Valley Railroad is at work on its proposed immense terminal at Greenville, N. J. Three piers are part of the project, one of which will be finished as soon as possible, the first part to be completed being 3,000 feet long, the total length of each pier being 7,000 feet.

When completed the three piers will provide dock space six miles long, with open and warehouse storage facilities and the most modern machinery for loading and unloading ships, including traveling gantry cranes of the revolving type. Cars will come to ship's side direct, provision being made on the piers, which will be, respectively, 400, 550 and 350 feet wide, for both storage and classification tracks.

Slips between the piers will be 550 feet wide at the pierheads, tapering inshore to a minimum width of 450 feet, a feature which is expected to facilitate handling of ships in and out of the slips, making it possible to navigate the slip channels while other vessels occupy berths on both sides.

The first pier unit to be built will be approximately alongside the Pennsylvania Railroad's Greenville terminal. It is intended to replace the Lehigh Valley's ore dock at Constable Hook, and with the other new piers to supplement the Lehigh Valley docks at Black Tom and at the Tidewater Terminal in Jersey City.

The new development will cover about 635 acres. It is intended to fill in hydraulically, with dredging material, a portion of this area, bringing the shore line along the new project out approximately in a line with the shore line of the Standard Oil Company's Eagle Oil Works, which adjoin the site of the new development on the north. As planned, the piers will extend to the pierhead lines established by the War Department in 1915, which is some distance beyond that established in 1883 by the old Riparian Commission of New Jersey. This will bring the long piers practically to deep water in New York Bay.

The channel now being dredged for the first pier unit will be 300 feet wide, but will be widened as the larger project progresses. The immediate operation requires the removal of 3,600,000 cubic yards of material, which will increase to 12,000,000 yards when the development is completed. The channels will be dredged to a depth of 35 feet at mean low water, making it possible to bring to the docks ships of the largest size. The first pier unit will accommodate two 600-foot 20,000-ton ships at the new ore dock, two more at the warehouse dock and a fifth at the open dock.

$4,000,000 OCEAN LINERS FOR PACIFIC STEAMSHIP COMPANY

Admiral Line to Have Two Great Passenger Carriers for Coast Service Out of Seattle

Announcement has been made that the Pacific Steamship Company, of Seattle, has perfected plans for the construction of two ocean liners to cost approximately $4,000,000 each, which will be put into the service of the Admiral Line of steamers between Puget Sound and California ports. This action on the part of the company has been caused by the refusal of the War Department to consider the disposal of the army transports *Great Northern* and *Northern Pacific*, and the sale of the steamers *Yale* and *Harvard* to a Los Angeles concern.

The ships are planned to be the last word in passenger liners, and they are to be built at the earliest possible moment. Full details of their construction will not be given out, it is said, until the contracts have been let. These contracts will not be placed until the Pacific Steamship Company has carefully considered every bid, especially tenders for the work which will be made by Pacific Coast yards, as well as builders on the Atlantic coast, who have been invited to submit bids. It is understood that the preference will be given to Pacific Coast yards, other things being equal, but in case the contracts come to the Atlantic coast the company plans to run a big excursion when the steamers are launched, from New York to the Pacific by way of the Panama Canal, with stops at San Pedro, San Francisco and Seattle. Present expectations by the company are that eighteen months will be required for the construction and equipping of these vessels, which indicates that no pains will be spared to make them floating palaces. It is hoped by the company that they will be able to have them in commission and operating out of Seattle by January, 1922.

Steward Gear Stands Test

The Steward Boat Release Gear is guaranteed to meet the approval of the British Board of Trade, United States Steamboat Inspection Service, Lloyds, American Bureau of Shipping, and all other classification societies, both in this country and abroad.

It is believed that this is the only all-American release gear backed by such a guarantee.

In a recent test conducted by the British Board of Trade the following procedure was carried out with a 30-foot boat with a load of 6.80 tons:

The boat was hoisted to the lower bridge rail and lowered again with jerks until water-borne and then released; one end of the boat at a time was hoisted clear of water and then released; the boat was hoisted clear of water (not water-borne) and then released; towed with both tackles hooked and then released, and towed with one tackle hooked and then released.

This test is a very severe one, and it is felt that a releasing device properly functioning under it is worthy of the attention of the shipping industries.

George A. Armes, president of the Moore Shipbuilding Company, of Oakland, Cal., is in Europe with a staff of engineers making a study of Diesel engine construction, with a view to securing a license and building these engines at the Moore plant. Two steamship companies have signified their intention of placing orders for new tonnage with the Moore Company as part of their building programme.

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DOULLUT & WILLIAMS TO EXPEND $2,000,000 ON PLANT

New Orleans Concern Will Have Immense Fabrication Building, and Repair Shops and Yards

According to an announcement from New Orleans the Doullut & Williams Shipbuilding Company is preparing to expend $2,000,000 in enlarging its present facilities at the Lake Ponchartrain entrance of the Industrial Canal, and making an immense ship repair plant, with two floating docks of 10,000-ton capacity, and a shop for the fabrication of steel for bridges, buildings and barges as well as large ocean-going steamships. Steel vessels now under construction at the big plant will be completed and work on others started.

Horace Williams, secretary-treasurer of the company, speaking of the plan, said:

"The company intends to continue with the construction of vessels of the 9,000-ton deadweight class and larger. We will construct barges and tugs, and fabricate steel for all classes of structures in addition to operating the ship repair plant. The addition of a ship repair plant such as is contemplated will put New Orleans in the forefront of Gulf and South Atlantic ports, in so far as facilities for handling work of this nature are concerned."

The present plant of the company consists of four sets of ways, each 500 feet long, built continuously in such a manner that any length hull can be constructed without changing the ways. There is an outfitting dock at which four vessels can be handled simultaneously; a fabricating shop, machine shop, sawmill, three warehouses, rigging loft, large power house, cafeteria, office building and some four miles of yard track. The site of the plant comprises some 65 acres, which were built up by the use of hydraulic dredges, the removal of material also providing deeper water.

SHRINERS HAVE A SHIP

Harriman Yard Launches the Salaam After a Parade

The Shriner ship *Salaam* was launched April 24 at the Merchant Shipbuilding Corporation yard, Harriman, Pa. The brilliant uniforms of Shriners from three cities lent an Oriental touch of color to the scene, and about 1,000 persons witnessed the parade that preceded the launching.

The steel cargo vessel, named in honor of the war work of Salaam Temple, A. A. O. N. M. S., Newark, N. J., was sponsored with champagne by Mrs. Miles W. Beemer, wife of the illustrious potentate of that temple. Members of Lu Lu Temple, Philadelphia, and of Crescent Temple, Trenton, N. J., took part in the ceremony.

In the parade were the shipyard's kiltie band and its well-drilled firemen and guards, and Boy and Girl Scouts of Harriman and Bristol. The sponsor's party included G. K. Nichols, of the Emergency Fleet Corporation; W. T. Wilson, works manager and a member of Salaam Temple, and Mrs. Wilson, Mr. and Mrs. E. S. Fancher, J. V. Donahue, E. L. Fries, Edward S. Breen and H. W. Egner, Jr.

The *Salaam*, an 8-000-ton vessel, is the twenty-eighth of forty ordered by the Government. It brought the yard's total launched tonnage to 225,000.

Bayles Yard in New Hands

The New York Harbor Dry Dock Corporation has taken from the Shipping Board the Bayles Shipyard at Port Jefferson, L. I., and on June 2 will send a 3,500-ton ship down the ways. A short time ago the 1,200-ton tanker *Anahuac*, which was built at the yard for the Nyack Shipbuilding Company, was launched. The vessel is of 7,000 barrels capacity, 180 feet long between perpendiculars, 31 feet molded breadth and 16 feet depth.

New Refrigeration Machinery Supply House

The new building of the Shipley Construction & Supply Company, on Second avenue, Forty-first to Forty-second streets, Brooklyn, N. Y., is one of the largest supply houses in the world devoted exclusively to furnishing machinery, apparatus and supplies to ice-making and refrigerating plants. They now have about 3½ acres of floor space.

The warehouse is stocked with a complete line of supplies and equipment for the ice-making and refrigerating plant, including a line of York refrigerating machines up to 30 tons capacity. During the last few years the company has equipped many ships with refrigerating plants, hence they have certain departments of their new shops specially for doing marine refrigerating work. Their location is ideal for this work, being within a city block of the Bush Terminal, with their own railroad sidings.

The Shipley Construction & Supply Company is the New York, foreign and marine representative of the York Manufacturing Company, of York, Pa. They have branch offices and stock houses in Albany, Rochester and Buffalo, N. Y., and New Haven, Conn., also agencies in practically all of the larger foreign countries.

$1,500,000 DOCK MERGER

Iron Works and Shipbuilding Company Consolidate

The New Orleans Dry Dock & Shipbuilding Company, of New Orleans, and the Johnson Iron Works have been consolidated, the deal involving $1,500,000. The new name of the concern will be the Johnson Iron Works, Dry Dock & Shipbuilding Company, Inc. The Johnson Iron Works has been in the marine repair business in New Orleans for sixty years, and the drydock company has been established for fourteen years.

Management of the new company will be in the hands of Wilmer H. Johnson and Warren Johnson, who have directed the affairs of the Johnson Iron Works for many years.

The plants of the two companies include a total of 1,750 feet of river frontage on the west bank of the Mississippi River, immediately below the Canal street ferry landing. The plants virtually adjoin each other. The new company will also operate the shipbuilding plant on Bayou St. John, where the Johnson Iron Works has been building tugs for the Government.

The New Orleans Dry Dock Company's three drydocks will pass to the new company. No. 1 drydock has a capacity of 5,000 tons, No. 2 is of 2,000 tons capacity, and No. 3 is a smaller drydock used for river boats and tugs.

WILL CUT LAKE TRAFFIC

Seamen's Act Blamed for Restriction Service

Announcement comes from Detroit that many lake ports, including Toledo, Sandusky, Put-in-Bay, Port Huron, Oscoda, Rogers City and Cheboygan, will lose a great part of their passenger and freight steamboat service this season.

Some of the ports will be abandoned altogether, owing to the action of the Detroit & Cleveland Navigation Company in restricting service on the Mackinaw division, and the removal of the steamer *Frank L. Kirby* from the Detroit and Sandusky run.

The La Follette seamen's act is blamed.

During the season of 1919 the line just about broke even, notwithstanding the fact that all lake lines enjoyed the largest business in their history, according to A. A. Schantz, president and general manager of the Detroit and Cleveland lines.

The company will operate the steamers of the Mackinaw division between Detroit, Alpena, Mackinac Island and St. Ignace this season, cutting out the stops at Toledo, Port Huron, Oscoda, Rogers City and Cheboygan. The boats will only be operated during the height of the season, from June 15 to September 15. If this plan proves unprofitable the line will be abandoned.

The Ashley & Dustin Line has definitely abandoned the freight line to San-

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dusky and the Lake Erie islands, and President Dustin declares that the seamen's act is the chief agent in causing the difficulties of the line, formerly a big money-maker, which in late years has operated at a loss.

It is reported that the Arnold line, which operated boats between Mackinaw and the Soo in past seasons will abandon the line this year.

Launches First Fruit Steamer

On Saturday, May 8, the Standard Shipbuilding Corporation launched, at its Shooters Island yard, the first of two fruit steamers for the Cuyamel Fruit Company, of New Orleans. Miss Josefa Juvé, sister of the first vice-president of the Standard Company, named the ship *Hibueras*.

This vessel is a special type combination passenger and cargo steamer, and is 235 feet long, with a 34-foot beam and 16-foot depth. She has accommodations for thirty passengers and will have a speed of 11 knots. This steamer and a sister ship, being finished, will be used in the fruit trade with the West Indies. These steamers are being built under the supervision of William Gardner & Company, naval architects and engineers, of 1 Broadway, New York.

Besides these fruit steamers the Standard Company is constructing four 8,400-ton oil tankers of the "Gold Shell" type for the Eagle Oil Transport Company, of London.

Consolidated Launches an Express Cruiser

An 80-foot express cruiser, being built for Mr. John W. Kiser, of New York City, by the Consolidated Shipbuilding Corporation, was launched at their yards, Morris Heights, New York City, on May 7. Mrs. John W. Kiser was sponsor for the yacht, which was named *Fillette*.

The *Fillette* is 80 feet long and has a beam of 13 feet. The propelling machinery consists of two eight-cylinder 200-horsepower each Speedway motors. The deck accommodations are well appointed, and the interior arrangement is exceptionally attractive; when completed this boat promises to attract considerable interest throughout the yachting fraternity.

The launching of this new cruiser adds one more to the large number of handsome yachts to be delivered by the Consolidated people this year.

Oceanic's House Flag

The Bureau of Navigation of the Department of Commerce gives the description of the house flag of the Oceanic Steamship Company, of San Francisco, which was registered recently, as a white rectangular field having a red stripe around its periphery and a blue ring superimposed in center within which is a red five-pointed star, each point touching the inner circumference of the ring.

AMERICAN YARDS LOSE LEAD, SAYS LLOYD'S REGISTER

First Quarter of the Year Shows British Yards With a Margin of 821,000 Tons—American Ships Average Larger

The world's shipyards are building a greater volume of seagoing tonnage today in the shape of steel steamships than ever in their history, says a statement recently issued by *Lloyd's Register of Shipping*, giving returns from all maritime countries. Steel steamers under construction for the quarter ended April 1 are reported to have aggregated 7,692,000 gross tons, as compared with 4,935,000 tons at September 30, 1918, and 7,504,000 tons at September 30 last, the last named being the high record until the quarter just ended.

The total tonnage of all kinds under construction shows a decrease, however, the aggregate being 7,941,000 tons, as against 8,048,000 tons on September 30, 1919. This is accounted for by the progress of the Shipping Board's programme towards completion and the marked decline in the building of wooden steamers. Only 105,000 tons of this type of construction are under way, as contrasted with 1,324,000 tons just before the armistice, since which time there has been a steady falling off.

Great Britain in First Place

Figures for the first quarter of this year show that Great Britain now holds the lead in shipbuilding over the United States by a margin of 821,000 tons, although this country led by 1,930,000 tons a year ago. At the beginning of this year the two countries were neck and neck, the advantage being only slightly with the United Kingdom. The following table shows how the two countries have stood relatively at the ends of the various quarters in the total of gross tons under construction:

	United States	United Kingdom
Sept. 30, 1918.....	3,382,000	1,746,000
Dec. 30, 1918.....	3,645,000	1,979,000
Mar. 31, 1919.....	4,185,000	2,254,000
June 30, 1919.....	3,874,000	2,524,000
Sept. 30, 1919.....	3,470,000	2,816,000
Dec. 31, 1919.....	2,966,000	2,994,000
Mar. 31, 1920.....	2,573,000	3,394,000

This includes all types of tonnage. In the construction of steel steamers the margin is a wider one. At September 30 last the United States still led by 279,000 gross tons; but by the end of the year the United Kingdom had a lead of 334,000 tons, and has now extended it to 961,000 tons.

American Ships Larger

But while Britain is building a greater number of steel steamers and a considerably greater aggregate tonnage than this country, the average size of her ships is considerably smaller, her 814 of 3,379,000 gross tons, averaging only 4,151 tons, as against 5,373 tons for the 450 American ships of 2,418,000 tons.

In the United States more tonnage of all kinds is being built in the shipyards of the Atlantic coast than in those of the Gulf ports, the Great Lakes and the Pacific Coast combined. In steel steamers the difference is even more marked, nearly 60 percent of this type of construction being under way along the Eastern seaboard. The following table shows the distribution by districts in gross tons:

	All Types	Steel Steamers
Atlantic Coast	1,602,167	1,585,827
Gulf Ports	213,193	180,793
Great Lakes	173,375	173,375
Pacific Coast	584,563	478,163
Total	2,573,298	2,418,158

A year ago the United States was building nearly 54 percent of all the tonnage under way in the world, as compared to 29 percent for the United Kingdom and 17 percent for all other countries. To-day this country is constructing 32 percent, against about 43 percent for Great Britain and about 25 percent for all other countries. Excluding Great Britain, however, America is building 80,000 tons more than all the other countries combined.

Japan Loses Third Place

Between them the United States and the United Kingdom are turning out three-fourths of the world's tonnage, and no other country is within measurable distance of either of them. Japan, which had held third place from the time of the armistice to the beginning of this year, has now been passed by both Holland and Italy, and is being pressed by France. All three of the latter made gains during the last quarter, while Japan fell back from 309,000 tons to 285,000.

The distribution of shipbuilding at the beginning of April, as compared with the previous quarter, was as follows, in gross tons:

	Mar. 31, 1920	Dec. 31, 1919
United States	2,573,298	2,966,515
United Kingdom	3,394,425	2,994,249
Canada	169,623	188,375
Other Dominions	61,636	63,105
Belgium	25,640	26,293
Brazil	5,366	.....
China	35,325	35,700
Denmark	114,851	100,335
France	240,225	216,775
Greece	1,500	1,500
Holland	366,581	328,338
Italy	355,241	314,547
Japan	285,676	309,474
Norway	90,449	92,719
Portugal	5,210	5,210
Spain	98,351	107,463
Sweden	118,553	110,765
Total	7,941,950	7,861,363

Of the total tonnage being built in the world at the beginning of April, excluding vessels the construction of which has not actually been commenced, and excluding all vessels of less than 100 tons, the total under inspection by *Lloyd's Register* amounts to 4,965,612 gross tons.

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PORTABLE ELECTRIC PLANER

An Adjustable Tool for Flat or Curved Work

In speeding up the wooden ship and submarine chaser building programme during the war, the Universal planer was developed to replace the jack plane method of finishing the sides and decks of ships. The device was found to be so practical in this connection that it has

Planer in General Use

been improved and placed on the market by the United States Electric Company, New London, Conn.

Some of the features of the device are its ease of operation, which requires no special training. Adjustments are made by means of special hand screws to control the thickness of the shaving. The

Planer on Curved Surface

base of the plane may be curved to suit the surface being worked upon, and this, together with the high cutting speed of the knives, insures a smooth and fair surface. The knives may be easily changed, and will cut hard or soft wood equally well. Motors are available to suit all currents, and the average power required is about 600 watt-hours. The plane may be connected to any electric light socket.

$178,835,000 IN NEW SHIPPING CONCERNS FORMED IN APRIL

Twenty-Two Concerns of $50,000 or More Incorporated—One for $150,000,000—Month Makes New Record

The April showing of incorporations of shipping, shipbuilding and allied interests, makes the largest aggregate of any one month since the war began, and brings the total for the first four months of 1920 above that for the whole of 1919, which stood as a record year in the *Journal of Commerce* compilation of these statistics.

The feature of the month's record was the organization in Delaware of the Garland Steamship Corporation, to take over the New York company of the same name. The new corporation has an authorized capitalization of 1,500,000 shares of no par value, 641,000 shares of which are to be distributed to stockholders of the British-American Tobacco Company. For the purposes of inclusion in the compilation the shares of this company are assigned a value of $100, which is the customary value of stock where a par value is given. On this basis the company contributes $150,000,000 to the monthly total.

The indicated investment in new enterprise of this character during January-April, 1920, appears as $350,370,000. This compares with $25,601,000 in the corresponding period of last year and with $324,123,000 in the entire twelve months of 1919. The average monthly indicated investment to date this year figures out as $87,592,500, against an average during 1919 of $26,967,750. The average per company in April was $8,128,864, compared with $2,945,237 in March, $1,363,530 in February, and $2,384,531 in January.

The indicated investment in new shipping enterprises during the periods indicated is shown in the following table:

August, December, 1914	$1,844,000
Year 1915	37,062,000
Year 1916	69,406,000
Year 1917	271,503,000
Year 1918	120,353,000
Year 1919—	
January	7,525,000
February	6,400,000
March	9,276,000
April	2,400,000
May	17,200,000
June	55,550,000
July	42,485,000
August	55,950,000
September	40,870,000
October	23,405,000
November	52,700,000
December	10,362,000
Total	$324,123,000
Year 1920—	
January	$76,305,000
February	33,380,000
March	61,850,000
April	178,835,000
Total four months, 1920	$350,370,000

Thirteen companies were organized during the month with an authorized capital of $1,000,000 or greater. This compares with twelve of similar proportions launched during March, seven in February and ten in January. The following list comprises names, State of incorporation and authorized capital of shipping companies organized in April:

Armenia Steamship Co., Del.	$1,500,000
Ardmore Steamship Corp., Del.	200,000
Atlantic & Gulf Transportation Co., Del.	1,000,000
Blue Star Navigation Co., Del.	1,000,000
Chillicothe Navigation Co., Del.	300,000
Columbia Dry Dock & Engine Corporation, Del.	7,000,000
Commerc'l Steamship Co., The Del.	500,000
Coosa Steamship Co., Del.	500,000
Dolphin Line, Inc., N. Y.	75,000
East Port Steamship Co., Del.	1,750,000
French-American Line of New York, N. Y.	5,000,000
Garland Steamship Corp., Del.	150,000,000
Haybron Steamship Co., Ltd., Del.	100,000
Hull-Pope-Yott Corp., Del.	110,000
Jeannette Steamship Co., Del.	2,500,000
Livermore, Rojas & Co., Inc., Del. (own and operate)	2,500,000
Monongahela Navigation Co., Del.	400,000
Moshulu Navigation Co., Ltd.	400,000
Neuse Steamship Co., Del.	1,000,000
New Hamburg-American Line of New York, Inc., N. Y.	1,000,000
Ocean Navigation & Transportation Co., Del.	1,000,000
Oconee Steamship Co., Del.	1,000,000
Total	$178,835,000

Royal Belge Buys More Ships

The Lloyd Royal Belge has acquired ten more freighters of the 4,000 tons gross type from the Shipping Board. This brings the fleet of the company up to a total of 84. The vessels, with their new names under the Belgian flags, are: *Knight Island (Devonier), Long Island (Argentier), Staten Island (Spartier), Shelter Island (Livonier), Fisher Island (Ionier), Piqua (Marconier), Waukesha (Meissonier), Middleburg (Grenadier), Lynchburg (Fusilier), Aurora (Carabinier).*

Light Vessel Launched

Light Vessel No. 103 was launched by the Consolidated Shipbuilding Corporation, at their Morris Heights yards, New York City, Saturday, May 1. Miss Beatrice A. Fromme, daughter of Harry Fromme, chief engineer of the Consolidated plant, christened the vessel. The ship is built of steel, 96 feet 5 inches in length, 24 feet beam, has a depth of 11 feet 9 inches, with a draft of 9 feet 6 inches. The propelling machinery consists of a double cylinder, 12 by 12, with 14-inch stroke engine, steam being supplied by a 9-foot 6-inch Scotch boiler.

The Light House Department, Washington, D. C., authorized the construction of this vessel, and her destination is the St. Claire River, Detroit, Mich.

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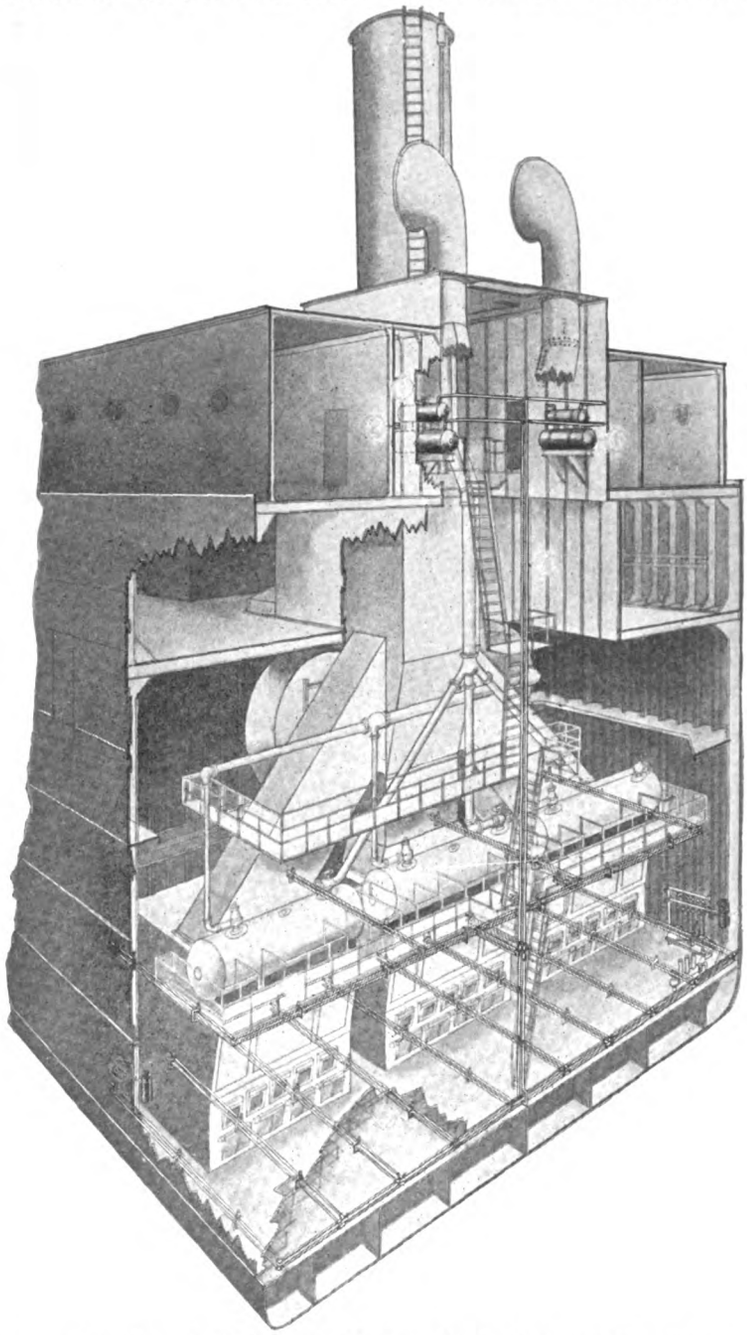
Protecting Boiler and Engine Rooms of Oil-Burning Vessels

The boiler and engine rooms in oil-burning vessels and motor vessels have represented one of the greatest fire hazards in the marine field. Until recently the only form of protection available in this part of the vessel was that afforded by hand extinguishers, which have been hardly adequate in taking care of the risk. Fire spreads so rapidly in the oil-soaked spaces that the crew is nearly always driven out of the hold. Extensive extinguishing systems which utilize steam or other gases in smothering the flame increase the danger to the crew.

Carbon dioxide puts out fire quicker than ordinary extinguishing agencies and prevents reignition. This gas has been utilized by the Foamite Firefoam Company, 200 Fifth avenue, New York, as part of a fire extinguishing system in which it is held in a tough foam blanket which smothers a blaze. The gas bubbles are retained in this foam until the burned surface cools, and there is no danger of the fire spreading.

It is claimed by the manufacturers of Foamite that it will not damage any part of the vessel; it is not injurious to the crew; does not affect steel, wood, fabric or any painted or varnished surface, and when dry only a fine powder remains, which is easily brushed away.

Boiler and engine rooms are usually saturated with the drippings from the burners, oil pumps and engines, the excess of which finds its way finally to the bilge. A break in the oil line, spraying the oil in all directions, or a back flash from the burners, may at any time spread a fire over the entire hold, driving out the crew and leaving no effective means of coping with it. For protection in such cases a sprinkler system by means of which the carbon dioxide foam blanket may be spread over the entire hold is installed. Two pressure tanks containing the proper solutions are connected by pipe lines to sprinkler heads in which the solution combine and are sprayed over the burning area. The controls for the system are located at any convenient point in the ship, and operate either automatically or manually, so that it is not necessary for the crew to remain in the fire region.



System for Spraying Carbon Dioxide Foam Blanket Over a Boiler Room

F. W. Sinram Honored

At the fourth annual convention of the American Gear Manufacturers' Association in Detroit, April 29, 30 and May 1, Mr. F. W. Sinram, president of the Van Dorn & Dutton Company, of Cleveland, was for the fourth time unanimously re-elected to the presidency of the association. It has been the policy of the association for the directors to elect all officers, and Mr. Sinram had requested that his name be not presented for the fourth term. In this instance the board elected the vice-president, secretary and treasurer, but left the naming of the next president to the association at large.

After the announcement of the three new officers, Mr. John B. Foote, president of the Foote Bros. Gear & Machine Company, Chicago, in behalf of the association, presented to Mr. Sinram a handsome gold watch and charm. Before the recipient had recovered from "shell shock" he had again been re-elected by acclamation.

The A. G. M. A. is the industry organization of the gear manufacturers, and includes in its membership practically every representative gear interest in the United States and Canada.

Morse Company Wins Bonus

Completing what is conceded to be a record ship bottom repair job, the Morse Dry Dock & Repair Company, of Brooklyn, N. Y., has earned from the Standard Oil Company of New Jersey, owners of the steamship *F. Q. Barstow*, upon which ship the work was done, a bonus of $1,000 per day for the three and one-half days within the contract.

The *Barstow* had been damaged as the result of being grounded after striking a submerged obstruction and being in collision with the steamer *Paddleford*, off Tampico, in the Gulf of Mexico. The tenders for repairing the ship were submitted on April 8, and as time was an important factor the Morse Company was awarded the work, although its bid was about $11,000 in excess of the low bid.

Work on the ship started at 1 o'clock April 9. It involved the removal and

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renewal of 85 plates, the repairing of frames and work throughout the tanks, the testing of the tanks, fairing and replacing in the way of hull damage. The ship was completed on Sunday afternoon, April 25. Some additional work was attended to on Monday and Tuesday, and on Tuesday evening, April 27, the work was completed.

The 30,000-ton floating drydock, and its close proximity to a highly organized plate and hull department, figured largely in the making of this record.

BUSINESS AND PERSONAL NOTES

The Foundation Company announces that it removed to its own building, No. 120 Liberty street, New York, on May 10.

H. W. Fielden, auditor, and C. F. Jemison, treasurer, of the Penn Seaboard Steel Corporation, 1417 Sansom street, Philadelphia, have been appointed comptroller and treasurer, respectively, of the Tacony Steel Company.

The Merchant Shipbuilding Corporation announces that on May 15, 1920, its general offices were moved from Finance building, South Penn Square, to Estey building, Seventeenth and Walnut streets, Philadelphia, Pa.

The Edward P. Farley Company announce the removal of their offices from 1501 Railway Exchange to the Tower building, 6 North Michigan avenue, Chicago.

Centrifugal pumps of the single- and multi-stage types for various services are described in an illustrated catalogue just issued by the De Laval Steam Turbine Company, Trenton, N. J. This company makes a practice of guaranteeing each pump fully as to the head, delivery and efficiency possible, as well as to the workmanship and materials, and each pump is tested before shipment. Manufacture is on an interchangeable basis.

Through an unfortunate oversight the name of the Ashton Valve Company, 137 Liberty street, New York, was omitted from the list of exhibitors at the Marine Exposition published in our May number. The company exhibited a full line of their pop safety and relief valves and pressure and vacuum gages.

The New Jersey Zinc Company, 160 Front street, New York, announces the appointment of Mr. Bushnell Bigelow as assistant general sales manager, and Mr. Walter I. Hess, manager of Eastern sales. Mr. Bigelow has held the position of manager of Eastern sales previously, and Mr. Hess has been assistant sales manager.

The United States Shipping Board, Emergency Fleet Corporation, has awarded a contract to the American Clay Machinery Company for sixteen electric capstans for use on drydocks being built for the Corporation.

C. S. Steen, chief engineer of the Tacony Steel Company, has been appointed chief engineer of the Penn Seaboard Steel Corporation. He will have supervision of all engineering and designing of the Penn Seaboard and Tacony plants. His new appointment gives him a much broader field in the New Castle, Chester, Tacony and New Haven works of the Penn Seaboard Steel Corporation.

H. McL. Harding, designing terminal engineer, Concourse building, 52 Vanderbilt avenue, New York, announces the removal of his offices from the above address to 5730 Grand Central Terminal, Forty-second street, New York, N. Y. Telephone, Vanderbilt 3038.

The Los Angeles Shipbuilding & Dry Dock Company has strengthened its organization by the addition of Commander James Reed, Construction Corps, U. S. Navy, to its executive staff. Commander Reed has resigned from the naval service and accepted the position of assistant general manager. He is a member of the American Society of Mechanical Engineers, and a graduate of the United States Naval Academy, Annapolis, Md., in the class of 1902. The officers and directors of the Los Angeles Shipbuilding & Dry Dock Company are now as follows: Officers, Fred L. Baker, president and treasurer; S. L. Naphtaly, vice-president and general manager; Dan Murphy, vice-president and assistant treasurer; Erle M. Leaf, secretary; James Reed, assistant general manager; F. G. Phillipps, comptroller; Francis P. Duncklee, assistant secretary; John Murray, works manager. Directors, J. F. Sartori, Erle M. Leaf, Dan Murphy, S. L. Naphtaly, Fred L. Baker.

The Black & Decker Company, of Towson Heights, Baltimore, have removed their Philadelphia branch office from the West End Trust building to more spacious quarters at 318 North Broad street. The new office has a show window and show room, as well as a completely equipped service station for the convenience of users of Black & Decker electric air compressors, portable electric drills and electric valve grinders. It is in charge of Mr. W. C. Allen, branch manager.

The Electro Sun Company, Inc., distributors of supplies and equipment for engineers, architects and draftsmen, announces the removal of its office from 27 Thames street to 161 Washington street, New York City. In connection with the expansion of this company a catalogue has been issued describing the materials and supplies available for engineers and draftsmen. The descriptions and specifications are complete, as the catalogue has been intended as a source of information in this particular field. The catalogue will be supplied by the company on request.

The Page Steel & Wire Company announce that since their consolidation with the American Chain Company their offices have been removed to suite 1054 Grand Central Terminal, New York City. Telephone, Vanderbilt 4050.

MARINE SOCIETIES

AMERICA

AMERICAN SOCIETY OF NAVAL ENGINEERS
Navy Department, Washington, D. C.

SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS
29 West 39th Street, New York.

NATIONAL ASSOCIATION OF ENGINE AND BOAT MANUFACTURERS
29 West 39th Street, New York City.

UNITED STATES NAVAL INSTITUTE
Naval Academy, Annapolis, Md.

NATIONAL ASSOCIATION OF MASTERS, MATES AND PILOTS
National President—John H. Pruett, 428 Forty-ninth St., Brooklyn, N. Y.
National Treasurer—A. B. Devlin, 187 Randolph Ave., Jersey City, N. J.
National Secretary—M. D. Tenniswood, 808 Vine St., Camden, N. J.

LIST OF OFFICERS, AMERICAN SOCIETY OF MARINE DRAFTSMEN
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Vice-President—C. E. Deiser, 6124 Nassau Road, Philadelphia, Pa.
Secretary—B. G. Barnes, 6 Meadow Way, Bath, Maine.
Treasurer—J. B. Sadler, P. O. Box 987, Norfolk, Va.
Executive Committeemen—G. W. Nusbaum, Washington, D. C.; E. H. Monroe, Washington, D. C.; John Thomson, Bethlehem, Pa.

NATIONAL MARINE ENGINEERS' BENEFICIAL ASSOCIATION OFFICERS
National President—Wm. S. Brown, 356 Ellicott Square Bldg., Buffalo, N. Y.
National Secretary-Treasurer—Geo. A. Grubb, 356 Ellicott Square Bldg., Buffalo, N. Y.

CANADA

GRAND COUNCIL, N. A. OF M. E. OF CANADA
Grand President—E. Read, Rooms 10-12, Jones Building, Vancouver, B. C.
Grand Vice-President—Jeffrey Roe, Levis, P. Q.
Grand Secretary-Treasurer—Neil J. Morrison, Box 886, St. John, N. B.
Grand Conductor—E. A. House, Box 333, Midland, Ont.
Grand Door Keeper—Lemuel Winchester, 306 Fitzroy Street, Charlottstown, P. E. I.
Grand Auditor—W. C. Woods, Toronto, Can.
Grand Auditor—J. C. Adams, 1704 Kitchner Street, Vancouver, B. C.

GREAT BRITAIN

INSTITUTION OF NAVAL ARCHITECTS
5 Adelphi Terrace, London, W. C.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND
39 Elmbank Crescent, Glasgow.

NORTHEAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS
Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

INSTITUTE OF MARINE ENGINEERS, INCORPORATED
The Minories, Tower Hill, London.

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Marine Construction News of the Month

Ship Contracts—New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIP CONTRACTS

Freighters, Ecorse, Mich.—The Great Lakes Engineering Works has prepared designs and plans for at least ten new freighters which will probably be built this summer.

Freighters, Manitowoc, Wis.—The Manitowoc Shipbuilding Company will build five 3,300 tons deadweight freighters for its own account, keels for which will be laid immediately.

Barkentines, Victoria, B. C.—Building of four wooden barkentines will be begun soon by the Victoria Ship Owners, Ltd., of Victoria, B. C. They will be 2,500 tons each, and will cost $250,000 each.

Tankers, Portland, Oregon.—The Northwest Steel Company, Portland, will build seven 12,000-ton tankers for the Swift Sure Oil Tank Transport Company. J. R. Bowles is president of the steel company.

Steamers, Pacific Coast.—Announcement is made that H. F. Alexander, president of the Pacific Steamship Company, is making inquiries regarding moderate sized steamers for operation on the Pacific Coast.

Steamers, China.—Orders for five steamers have been placed by the China Merchants Steam Navigation Company. Four will be built in Chinese yards and the other in a British yard. Details not yet available.

Tanker, Seattle.—The Skinner & Eddy Shipbuilding Company received a contract rfo two 13,500 ton oil tankers for Norwegian interests, requiring ten months to build. A 3,600 horsepower engine will be installed.

Passenger Steamers.—The New York & Porto Rico Steamship Company has had two 400-foot steamers designed by Theodore Ferris for passenger and freight service, and it is expected that bids will be asked for very soon.

Barkentines, Seattle, Wash.—The Frank W. Haviside Company, of Seattle, Wash., has purchased two of the big Ferris-type hulls built at Eureka, Calif., from the Shipping Board, and will complete them as five-masted barkentines.

Tankers, Pascagoula, Miss.—Negotiations are in progress for the building of six tankers at the National Shipbuilding Company's plant. The steamers will be of 3,800 to 4,000 net tons, and used in the Texas-Mexico oil trade.

Tankers, Sparrow's Point.—It is reported that two bulk oil carriers, of about 10,000 tons each, have been ordered by French interests from the Bethlehem Shipbuilding Corporation, Ltd. They will probably be built at the Sparrow's Point plant.

Cargo Steamers, Glasgow, Scotland.—The Cork Steamship Company, Ltd., have placed an order with Ferguson Brothers, Port Glasgow, for three steamers for the continental cargo trade. Swan, Hunter & Wigham Richardson, Ltd., are building four vessels for the same company.

Freighters, Norwegian-American Line.—Four new freighters for the Norwegian-American Line are being built by Napier & Miller at Glasgow, Scotland. Two are of 9,500 tons, and two of 7,500 tons. The Canadian Vickers, at Montreal, are building two 6,500-ton steamers for the same line.

Ice Breaker, St. Lawrence River.—The Canadian Department of Marine, Ottawa, Canada, has authorized the construction of an ice breaker for use on the St. Lawrence river. The vessel is to have 8,000 horsepower, will carry a crew of 90 men, and the estimated cost is $2,000,000.

Tankers, Orange, Texas.—The National Shipbuilding Company, of Orange, Texas, has purchased five of the Ferris-type ships at the plant of the Beaumont Shipbuilding & Dry Dock Company, Beaumont, Texas, will have them planked with creosote sheathing, and install tanks for their use in the oil trade.

Tankers, Everett, Wash.—The Norway Pacific Shipbuilding Company has received contracts for seven oil tankers and six oil storage basins to cost approximately $20,000,000. Five tankers will be of 10,000, and the other two 3,500 tons each. The storage basins will have a capacity of 300,000 barrels.

Steel Barges, Newark, N. J.—The Submarine Boat Corporation, has inaugurated construction of small cargo carrying all steel barges. The first fleet to be built will be used for canal service between Buffalo and New York. They will be built similar to the large fabricated steel vessels built for the Government.

Fruit Steamer, Newburgh, N. Y.—The keel for another ship for the Cuyamel Fruit Company has been laid at the Newburgh, N. Y., Shipyards. The vessel will be 301 feet 6 inches between perpendiculars, molded beam 42 feet, molded depth 25 feet, with twin screw reciprocating engines and three Scotch boilers, giving a speed of 14½ knots.

Tanker, Chester, Pa.—The Norwegian-American Line has placed an order with the Sun Shipbuilding Company Chester, Pa., for a 10,600-ton tanker, 430 feet long, 59 feet beam, 33 feet 3 inches deep, triple expansion engines, Scotch boilers, and with a speed of 10½ knots on a consumption of 30 tons of fuel oil daily. She will be built on the Isherwood system.

Passenger Liner, Camden, N. J.—The Munson Steamship Line, 82 Beaver street, New York, has placed a contract with the New York Shipbuilding Company, Camden, N. J., for a 15½-knot passenger liner of 6,000 tons gross register, oil burning, with steam turbine engines, and fitted especially for tropical service. The cost will be between $2,500,000 and $3,000,000.

Tanker, Camden, N. J.—The Sun Shipbuilding Company has received a contract from French interests for a 6,600-deadweight tank steamer. The name of the company ordering the steamer has not been made public. The Sun Company recently launched a steamer which was the first contract taken by an American yard from a foreign country after the armistice was signed.

Tankers and Barges, Bath, Maine.—The Texas Company has placed an order with the Texas Steamship Company for two 9,500-ton steel tank steamers, duplicating other vessels built at the company's yard, except that Scotch boilers will be installed; also for three steel harbor barges each with a capacity of 7,500 barrels of heavy Mexican oil. These barges are to be fitted with Scotch boilers to supply steam for operating cargo pumps, heaters, etc. The Carnegie Steel Company has the contract for the material involved.

Ore Steamer, Fore River.—The steamer Cubore, building at the Fore River plant of the Bethlehem Shipbuilding Corporation, Ltd., to be used in bringing ore from Cuba, will be of 11,400 tons deaweight, is 468 feet over all, 57 feet beam, 27 feet draft. She will be equipped with a 2,500-horsepower Diesel engine, and will have a speed of 10 knots loaded. In addition to the usual ballast tanks she will have side tanks, making practically a double hull, and six big hatches, allowing her to load in five and a half hours.

Passenger Vessels, Glasgow, Scotland.—In connection with the program for the extension of the fleet of the Nippon Yusen Kaisha (Japan Mail Steamship Company), Tokyo, William Denny & Bros., Ltd., of Dumbarton, have received from that company orders for two vessels, each 395 feet long and about 5,000 gross tons. These vessels are for fast passenger service, with a speed of 18½ knots. They will be built under the supervision of A. R. Brown, MacFarlane & Company, Ltd., the company's Glasgow agents.

Tanker, Staten Island, N. Y.—The Staten Island Shipbuilding Company will build for the American Sugar Refining Company, of New Jersey, a 6,300 deadweight ton steel combination bulk molasses and oil tanker; estimated cost $1,500,000. Dimensions: Length, 360 feet; molded breadth 50 feet, and molded depth, 29 feet. The vessel will be of steel, single-screw type, with straight stem and elliptical stern, built on the longitudinal system of framing, with two steel decks, raised poop, forecastle, bridge, with bridge house over house on poop deck. The machinery will be located aft. The pump room will be forward of the boiler room. There will be a double bottom under the machinery space with compartments for carrying feed water. The ship will be able to carry cargo in some of its compartments. The hold will be divided into six tanks, for oil or molasses in bulk, with a fuel tank between cargo tanks Nos. 3 and 4.

SHIPYARDS AND DRYDOCKS

Drydock, New Orleans, La.—The Jahncke Dry Dock & Ship Repair Company, New Orleans, will equip a third drydock with a lifting capacity of 6,000 tons.

Drydock, Seaford, Del.—The Delaware River Shipbuilding & Repair Company has placed a contract with the Crandall Engineering Company, of Boston, for the construction of a 3,000-ton dry dock at its Seaford, Del., yard.

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Shop, Fairfield, Md.—A permit for the construction of a one-story shop, 60 by 400 feet to cost $67,000 has been granted to the Globe Shipbuilding & Dry Docks Company, which is building a plant at Fairfield, Baltimore.

Steel Shop, Quincy, Mass.—The Bethlehem Shipbuilding Corporation Ltd., has awarded a contract to Snare & Triest, 8 West 40th street, New York, for a three-story concrete steel shop addition to its Fore River (Mass.) plant, to cost about $75,000.

Schooner, East Boothbay, Maine.—At the Adams yard a schooner of 105 feet keel, to be used for trading purposes between San Francisco and the South Sea Islands, will be ready for launching in June, and will be equipped with a Standard 45 H. P. engine.

Cargo Carrier Launched, Bath, Maine.—The Texas Steamship Company on May 1 launched the 10,000-ton cargo carrier Occidental at its Bath, Me., yard. The company has two more 10,000-ton ships on the ways, and more vessels to build as fast as the ways are vacated.

Marine Railway, Portland, Ore.—Supple & Martin are planning a marine railway for their shipbuilding plant at Linnton. The railway is to be provided with laterals, which will bring ships to be shunted to the machine shops and sawmill. The new device is expected to lift a vessel out of the water in thirty minutes.

Shipyard Sold, Portland, Oregon.—The Northwest Steel Company, Portland, ha sold its shipbuilding plant to the Northwest Bridge & Iron Company, a new organization. Contracts recently awarded to the Northwest Steel Company for seven 12,000-ton steel tankers by the United States Shipping Board were also taken over.

Marine Railway, Boothbay Harbor, Maine.—The Atlantic Coast Company, owned principally by Crowell & Thurlow, of Boston, is soon to begin building a marine railway capable of hauling out vessels of more than 2,000 tons, at its Boothbay Harbor yard. At present there are two 1,200 four-masted schooners at the yard, which will be launched this fall.

New Yard, Sturgeon Bay, Wis.—Joseph Wolters, who sold his shipyards at Sturgeon Bay to the Universal Shipbuilding Company two years ago, plans to build a new yard which will have one of the largest floating drydocks on the lakes. Prominent men in the shipping interests of that section of the lakes are financially interested in the project.

Tankers, Port Jefferson, L. I., N. Y.—The Bayles Shipyard at Port Jefferson, Long Island, which has been taken over by the New York Harbor Dry Dock Company, has launched the tanker Anahuac She is of 1,200 tons displacement, 180 feet long, 31 feet beam, 16 feet depth, with a capacity of 7,000 barrels, and was built for the Nyack Shipbuilding Company. A 3,500-ton ship will be launched on June 2.

New Shipyard, Algiers, Africa.—A company is forming at Algiers for the purpose of erecting a shipbuilding plant. According to reports three slips will be constructed at Fort de L'Eau, in the center of the Bay of Algiers, and it is hoped during the first year of the company's existence to complete the hulls of three vessels of 3,000 to 3,500 tons each. It is proposed to build the hulls only in Algeria.

Manila Dock Merger, H. I.—The Honolulu Iron Works, a Hawaiian firm, and Earnshaw's Slipways & Engineering Company, a Philippines concern, have been merged into a corportion known as Earnshaw's Dock & Honolulu Iron Works, which among other things, will operate a large dry dock and ship repairing establishment. At present about 2,000 men are employed in ship docking and repairing.

Fruit Steamer, Staten Island, N. Y.—The Standard Shipbuilding Corporation launched the first of two fruit steamers built for the Cuyamel Fruit Company, of New Orleans, on Saturday, May 8. The vessel is named the Hibueras, and is a special type combination passenger and cargo steamer, 235 feet long, 34 feet beam, 16 feet deep. The company is also constructing four 8,800-ton of the "gold shell" type, for the Eagle Oil Transportation Company, of London, England.

Freight Terminal, Greenville, N. J.—The Lehigh Valley Railroad plans three piers, to be known as the Claremont piers, at its terminal in Greenville. The first half of one of the piers about to be built will be 3,000 feet long, and each of the three piers when built will be 7,000 feet long. They will provide six miles of dock space with open and warehouse storage facilities and all modern features. The piers will be 400, 350 and 300 feet wide, with slips 500 feet wide at the pier heads, tapering to a maximum inshore width of 450 feet. The first unit will replace the Lehigh Valley's ore dock at Constable Hook, and the whole operation will require 12,000,000 cubic yards of dredging.

PORT IMPROVEMENTS

Bulkheads, Miami, Fla.—The Alton Beach Realty Company plans to construct 2½ and 2-mile bulkheads at Miami, Fla.

Pier, Marcus Hook, Philadelphia.—The Sun Oil Company plans to build a pier at its property at Marcus Hook. It will be a solid structure, 520 feet long and 200 feet wide.

Wharf, West Norfolk, Va.—S. G. Williams & Company has been awarded contract to build a wharf for Hastings Brothers, stevedores, at West Norfolk, Va., estimated cost $25,000.

Sea Wall, Boston, Mass.—City has let contract for building 1,350 foot concrete sea wall and back fill at Albany street, to N. S. Rendle, 364 Border street, East Boston, Mass. $200,823.

Piers, New York.—Bids will be received until June 2 by Murray Hulbert, Commissioner of Docks, Pier A, North River, for building piers at Stanton street, East River. About $200,000.

Dredging and Repairing Pier, New York.—The city has begun the work of dredging and repairing at Pier 72, at East 24th street, to cost about $90,000. When the work is completed the pier will be leased to the highest bidder.

Pier, New York City.—Murray Hulbert, Commissioner of Docks, Pier A, North river, has let contract for lumber pier and freight shed at 5th street, East river, to Associated Contractors Corporation, 17 West 42nd street. $122,790.

Pier, Jersey City, N. J.—Henry Steers, Inc., 17 Battery Place, New York City, has been awarded contract to build a pier and channel warehouse at Jersey City for the Claremont Terminal, Lehigh Valley Railroad, of 143 Liberty street, New York City.

Breakwater, Toronto Island, Ontario, Canada.—The Department of Public Works has let contract for building rubble mound breakwater on brushwood fascine mattress in Lake Ontario to R. McDonald Company, Ltd., Crown Office building, Toronto. $201,840.

Wharf, Astoria, Oregon.—G. W. Sanborn Company let contract for building 500 foot wharf, 125 foot railway extension from railroad to pier head line, two 50x110 feet slips, 40x75 feet pier and warehouse to Hilpin Construction Company, Astoria. About $70,000.

Steamer Dock, Vancouver, Wash.—City having plans prepared for building first unit of new steamer dock, 964 feet frontage, concrete and steel with frame wood piling, including 100x500 foot warehouse. About $130,000. A. C. Shumway, Vancouver, engineer.

Terminal, Providence, R. I.—The Zenith Transportation Company has leased the north side of the State pier on Allen's avenue, Providence, and will make it a terminal for cargo steamers to and from the Atlantic Coast and European points. The company is a subsidiary of M. F. Donovan & Sons, 100 Broadway, New York.

Quay Reconstruction, The Clyde, England.—The trustees of the Clyde Navigation, Glasgow, Scotland, have awarded to Sir William Arrol & Company, Ltd., a contract for extending 375 lineal feet of quayage at the net cost of materials and wages plus £20,000 for all charges, use of plant, and commissions; total estimated cost £94,000.

Marine Railway, Portland, Oregon.—The construction of a marine railway to cost about $250,000, which will accommodate vessels 300 feet in length, has been determined upon by Supple & Martin, operating the former plant of the Columbia Engineering Works at Linnton. No definite plans have been decided as to when construction will begin.

Bulkhead Wharf, San Francisco, Calif.—State Board Harbor Commission, Ferry building, let contract for building wood pile and cement bulkhead wharf in front of pier 27, connecting existing bulkhead wharves at piers 25 and 29 and constructing pile wharf connecting piers 25 and 27 to Healy, Tibbits Construction Company, 9 Main street; $38,717. State furnishes creosoted piles and cement.

Port Improvements, Philippine Islands.—Consideration of the establishment of a free zone in Manila and the decision to issue $6,000,000 of Government bonds for port works improvement are important steps taken by the Philippine Legislature. Among contemplated improvements to Manila harbor are the construction of additional piers, the tunneling of the Pasig river, the construction of coal and oil depots, and the dredging of the harbor to a depth of forty feet.

Terminal Facilities, New York City.—Bills have been signed by Governor Smith, of New York, authorizing the City of New York to construct terminals and warehouses, and providing for the straightening of the Harlem Ship Canal. Murray Hulbert, Dock Commissioner, says that probably $35,000,000 will be spent within the next two years as an initial outlay, of which $25,000,000 will go toward the terminal and warehouse establishment at Stapleton, S. I., and $9,500,000 for the Harlem river improvement project.

GOVERNMENT WORK

Dredging, Cleveland, Ohio.—United States Engineer Office, Federal building, has let contract for dredging and removing wharf in Huron Harbor to Great Lakes Dredge & Dock company for $24,191.

Crane Runway, Washington, D. C.—Specification 4174. Bureau of Yards and Docks, Navy Department, receives bids for building on existing foundations about 213 tons structural steel to form extension to Gun Park crane runway at Navy Yard. About $4,400.

Preparing Plans.—Plans are being prepared and bids will be called for by U. S. Engineers' office, Washington, D. C., when ready, for constructing new pier and dredging Newport; specification 4090; alteration to marine railway, Rockaway, L. I., specification 4184.

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Steel Catamarans for Porto Rico.—The United States Engineer's Office, War Department, Washington, D. C., let contract for steel catamarans for dredging in San Juan harbor, Porto Rico, to Greenlie, Halliday & Company, 499 Water street, New York. About $46,000.

Tracks, Naval Drydock, South Boston, Mass.—Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids for completing track system around drydock for special heavy drydock crane, and standard railroad equipment, etc.; specification 4196; about $120,000; $10 deposit for plans, etc.

Navy Yard Improvements, Philadelphia, Pa.—The Navy Department, Washington, D. C., is arranging for additions and improvements at the League Island Navy Yard during the coming year. The estimated expenditures are placed at $17,268,360, and this amount has been incorporated in the naval bill is now written; $11,000,000 will be used for construction and repair work, $2,500,000 for steam engineering service, $780,000 for ordnance and $1,000,000 for supplies.

Dredging, Saybrook, Conn.—United States Engineering Office, Providence, R. I., will receive bids until June 7, for maintenance dredging on Saybrook Bar, at the mouth of the Connecticut river.

Dredging, Malden River, Mass.—The United States Engineer's Office, Custom House, Boston, will receive bids until June 10 for dredging in Malden River, Mass. Information on application.

Dredging, New Jersey.—United States Engineering Office, 39 Whitehall street, will have specifications made for maintenance dredging in Keyport harbor, Shrewsbury river and other places in New Jersey.

Dredging Channel, Gulfport, Miss.—Work on the Gulfport channel has been started according to Major R. S. Thomas, United States engineer, and shoal places between the pier and Beacon 19 will be cleaned out.

Rebuilding Quay Walls, Scotland.—Among a number of schemes of harbor improvements which the Clyde Trustees have on hand at present is the reconstruction of the quay walls which collapsed at two parts of the harbor. It has been agreed to construct the quay wall 10 feet further into the river.

SHIPPING DEVELOPMENTS

Steamship Service, Mobile, Ala.—The Isthmian Line service from Mobile was inaugurated by the sailing of the steamer Chickasaw City, of the United States Steel Corporation, on May 14.

The New England Maritime Corporation, of Boston, has changed its name to North Atlantic & Western Steamship Company, providing monthly freight service between Boston and Pacific Coast ports.

Steamship Line Sold, Montreal, Canada.—Canada Steamship Lines, Ltd., has sold the Quebec Steamship Company lines operating between New York and the West Indies, to Furness, Withy & Company, Ltd.

Steamship for Coal Trade, Charleston, S. C.—The fleet of vessels operated by the Clinchfield interests in the coal trade between Charleston and Cuba has been increased by the addition of the steamer Cotopaxi.

Barge Line, Troy, N. Y.—The barge Edna Schum was launched at Kingston for the Lighters' Transportation Company, of New York, which inaugurated a barge line between Troy, Albany and New York.

New Shipping Company, London, England.—The Urbs Shipping Company has been organized with a capital of £50,000 to carry on the business of shipowners, etc. Solicitor, M. W. Starling, 5-6 Great Winchester street, E. C.

Reconditioning Steamer.—The passenger steamer Powhatan, 10,831 tons, chartered by the Shipping Board to the International Bureau of Supplies, is to be reconditioned by the charterers at a cost estimated at $2,350,000.

Restricting Loans, England.—British bankers are restricting loans on new shipping enterprises. One Cardiff concern, which had relied on a 50 percent loan on a newly bought steamer, was informed by the bank that it would lend only 30 percent.

Belgium Buys Steamers.—Two more American built steamers, the Fire Island and Long Island, both of Philadelphia, have been sold and placed under the Belgian flag. The Fire Island has had its name changed to Ionie and the Long Island to Argentinier.

Buy Steamers, New York.—The Elder Steel Steamship Company, 50 Broad street, New York, paid the United States Shipping Board in full for two steamers, the West Catanace and the Deerfield, the latter a refrigerator. The total cost of both vessels was $4,500,000.

New Steamship Company, New York.—The Five-Continent Steamship Company, 2 and 4 Stone street, proposes to operate ships in a number of trades soon. Robert S. Wild is vice-president and general manager, Lief S. Erickson chartering manager, and J. B. Magill traffic manager.

Pleasure Steamer, Great Lakes.—The Canada Steamship Lines are building a pleasure steamer for the Great Lakes service which will be fireproof and have a speed of 18 knots. It is planned to carry moving picture theatres, a children's playground, dancing pavilion, terraced decks, and other novel features.

Buys More Ships, Baltimore, Md.—The Standard Steamship Company, of 26 Cortlandt street, and Baltimore, is buying additional tonnage from the Shipping Board. The company's president is Guert G. Jackson; vice-president, J. F. Hefferman; treasurer, J. D. Childs, and secretary, J. B. Murray.

Harbor Tugs Bought, Norfolk, Va.—Two new river tugs, the Fannabelle Stewart and the Alexander Stewart, of 10 and 20 tons respectively, have been purchased by the Stone Towing Company, Wilmington, N. C. This makes a fleet of nine boats operated by the company at this port and Wilmington, N. C.

New York-Oriental Service, New York.—The Dollar Steamship Line inaugurated a new service between New York and the Orient with the sailing of the Grace Dollar of 6,000 tons capacity, the first of the fleet of freighters assigned to the route. The New York offices of the company are at 44 Whitehall street.

Transportation Line, Greenport, L. I.—Business men and others of Greenport, Sag Harbor, and other Long Island ports, are planning a transportation service between the east end of Long Island and New York. It is announced that they will form a company with $100,000 capital for that purpose, if they cannot make other arrangements.

Atlantic-Pacific Coast Service, Boston.—The first steamship, the Artigas, of the new line between Boston and Philadelphia on the East Coast, and San Pedro, San Francisco, Portland and Seattle on the west sailed from Philadelphia May 15. Another ship is booked for June 15. On their return voyages the vessels will call at San Juan, Porto Rico.

Portugal-Japan Line, Portugal.—The ex-German steamers Bulow, Prinz Henrich, Mark and Koenig Albert have been placed by the Portuguese Government at the disposal of the new service between Portugal and Japan. Two other liners and six cargo vessels will also be placed on this service which will be fortnightly.

New Shipping Company, Cardiff, Wales.—The Dawson Line, Ltd., has been registered with a capital of £200,000 to carry on the business of ship and tug owners, shipbrokers, shipping agents, carriers by land and water, etc. Directors are D. S. Dawson, J. M. Collings, W. J. Powell, T. Howe, and F. Dawson, 64 Merchants Exchange.

New Shipping Company, Newcastle-on-Tyne, England.—The Joplin & Hull Shipping Company, Ltd., has been organized with a capital of £100,000 to carry on the business of shipowners, managers of shipping property, etc. Directors, F. W. C. Common, L. A. Common, W. Joplin, C. E. Hull, B. E. Common, 15 Queen street, Newcastle-on-Tyne.

Late Delivery, Scotland.—The Peninsular & Oriental liner Naldera, which was under construction at the Greenock Works of Caird & Company when the war began, has just been delivered. She has been successively a cargo carrier, auxiliary cruiser and seaplane carrier, and is now a liner. Her changes have increased her ultimate cost to £2,000,000.

New Line, Port Newark, N. J.—The Transmarine Corporation, a subsidiary of the Submarine Boat Corporation, starts its first steamer, the Italia, to Havana on June 1. Other ships built at the Submarine's yards will follow. All the cargo the steamer can carry was supplied as soon as the announcement was made. Space was limited on account of channel conditions.

South American Service, Seattle, Wash.—The Pacific-Argentine-Brazil Steamship Line has begun a freight service from Seattle, Wash., down the North and South American coast, steamers returning to Seattle by way of Punta Arenas and the east coast of South America through the Panama Canal, touching at the principal ports. The first steamer in the service was the Pallas.

Standard Oil Shipping Committee.—As a result of the growth of its fleet of oil tankers and the increase in that branch of the company's business, a special shipping committee has been formed by the Standard Oil Company, of New Jersey, to exercise supervision over construction, repairing, maintenance and operation. D. T. Warden, manager of the marine department, is chairman.

Liner to be sold, England.—The British Admiralty has put up for auction the old passenger liner Teutonic, which is probably destined for the scrap heap. Up to 1910 she was in the Southampton-New York run and then went to Montral up to the beginning of the war. The British Admiralty bought her from the White Star shortly after the opening of hostilities, transforming her into an auxiliary cruiser.

Steel Company & Ship Lines Merger, Montreal, Canada.—The Dominion Steel Corporation, the Nova Scotia Steel & Coal Company, Canada Steamship Lines, Ltd., and numerous smaller companies have merged into one large company which has secured a charter under the name of British Empire Steel Corporation, Ltd., with an authorized capital of $500,000,000, which it is expected will be doubled.

New Steamship Line, Seattle, Wash.—The General Steamship Corporation, of San Francisco, has been named the agents for the Java-Pacific Line, which will establish a sea service between Seattle and Java on the arrival at Seattle of the 10,000-ton steamship Bondowoso. The General Steamship Corporation recently received the berth from the Shipping Board from San Francisco and other coast ports for Australia and New Zealand.

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INTERNATIONAL

MARINE ENGINEERING

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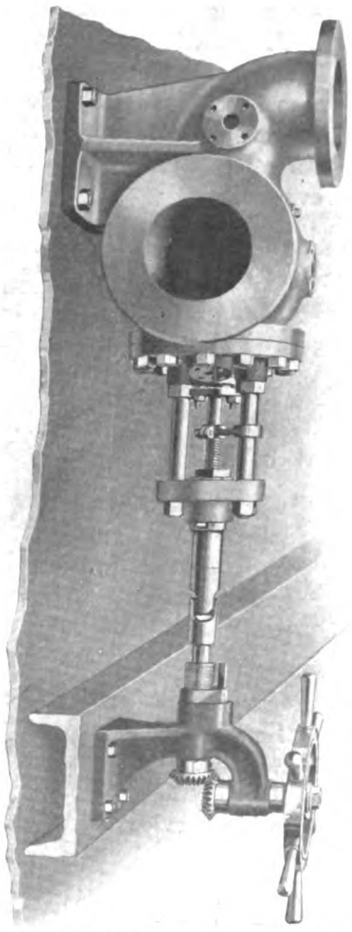

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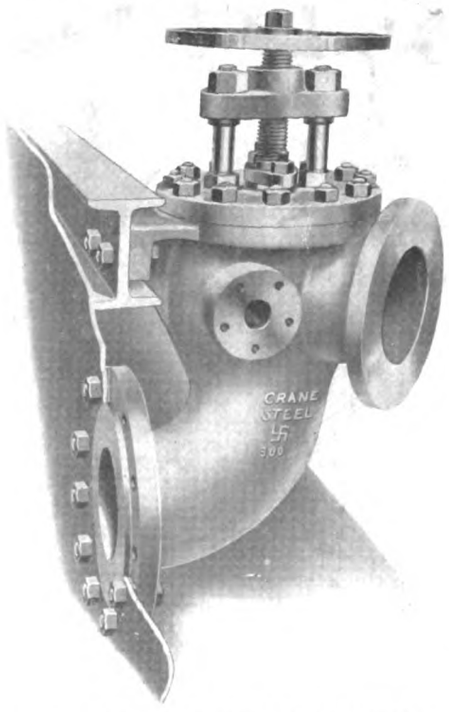

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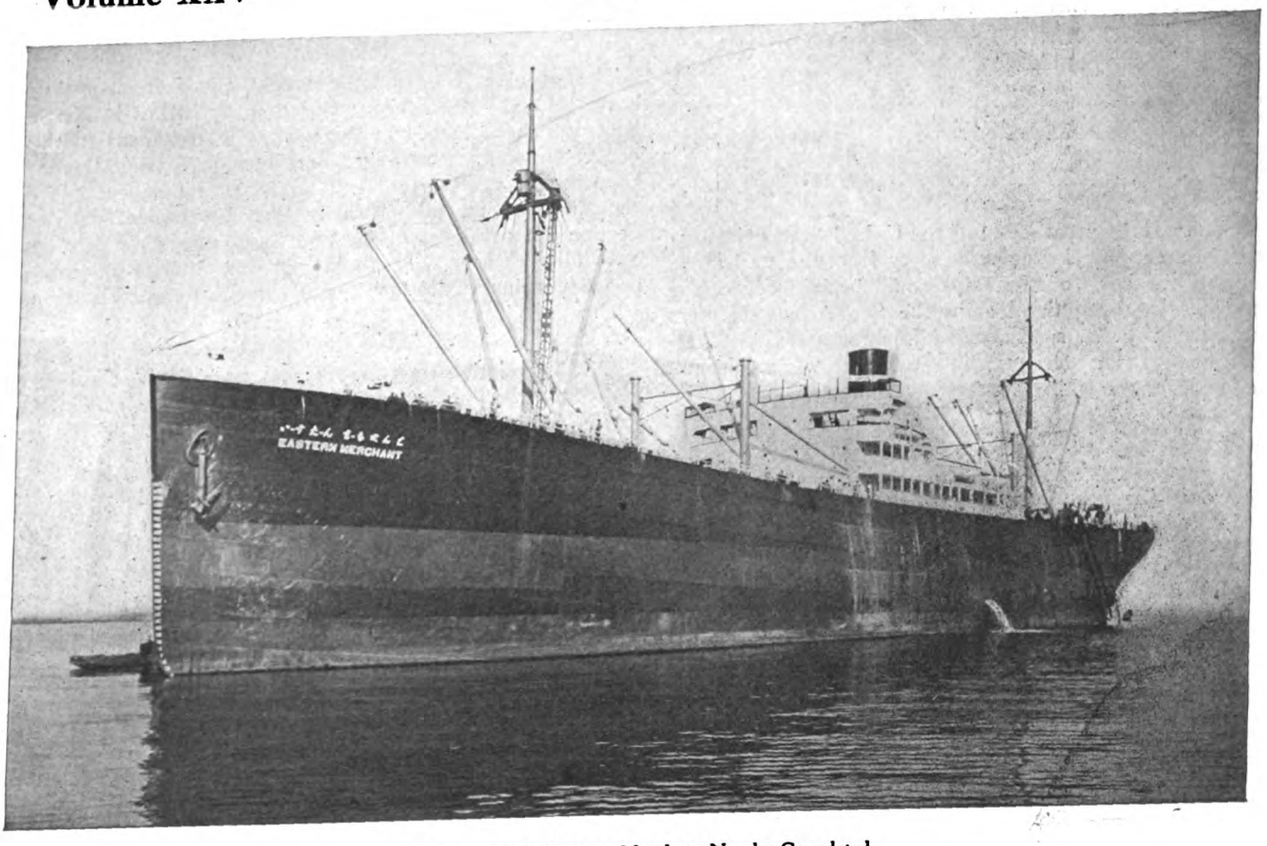

Fig. 1.— S. S. *Eastern Merchant* Nearly Completed

Twin Screw Cargo Ship Eastern Merchant

13,000-Ton Deadweight Freighter Built by the Asano Shipyard, Tsurumi, near Yokohama, Japan, for the United States Shipping Board

BY C. ANO*

DURING the late war, Japanese shipbuilders suffering from a lack of steel materials negotiated with the United States Government to build cargo steamers for them and to get steel in return. As a result of these negotiations two series of contracts were arranged between the United States Shipping Board and representatives of the Japanese shipbuilders.

The first series of contracts, which were signed during April, 1918, provided for the sale of twelve steamers of 100,800 tons deadweight by the Japanese shipbuilders at the rate of $225 to $275 per deadweight ton and for the release for export of 100,800 tons of steel already ordered by the Japanese shipbuilders from the various steel mills in the United States. The shipbuilders concerned in these contracts were the Asano Shipbuilding Company, Kawasaki Shipbuilding Company, Osaka Iron Works, Suzuki Company and Uraga Dock Company. Most of the ships under these contracts were, at the time of signing the contracts, ready for sea or in an advanced state of building, and contributed great assistance to the Allies in carrying war materials across the Atlantic. Later on three steamers having a total deadweight capacity of 27,000 tons were added to this series of contracts by the Kawasaki Shipbuilding Company.

The second series of contracts were signed in May, 1918, and their principal terms provided that the Japanese shipbuilders were to build and supply the ships to the United States Government at the rate of $175 per deadweight ton and that the United States Government was to supply the builders with half as many tons of steel material as the deadweight tonnage of the ships they supplied.

* Director and chief draftsman, Asano Shipbuilding Company.

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Following is the complete list of the shipbuilders and number and tonnage of the ships they are building under these contracts:

Builders	Number of Ships	Deadweight Tonnage of Each Ship	Total Deadweight Tonnage
Asahi Shipbuilding Company	1	5,500	5,500
Asano Shipbuilding Company	2	13,000	26,000
Fujinagata Shipyard	1	6,300	6,300
Ishikajima Shipbuilding and Engineering Works	2	5,000	10,000
Kawasaki Shipbuilding Company	5	9,000	45,000
Mitsubishi Shipbuilding Company	2	8,400	16,800
Mitsui Company (Uno Shipyard)	2	9,100	18,200
Nitta Steamship Company	1	5,500	5,500
Osaka Iron Works	4	10,500	42,000
Suzuki Company (Harima yard)	1	5,000 }	15,500
Suzuki Company (Harima yard)	1	10,500 }	
Uchida Shipbuilding Company	2	8,500	17,000
Uraga Dock Company	3	6,650	19,950
Yokohama Dock Company	3	6,300	18,900

In spite of the great effort of the United States Government in arranging for quick delivery from the steel mills, none of the keels of the ships could be laid before the armistice. Among those ships the two Asano steamers are considered fine specimens of Japanese naval architecture, being the largest and only twin screw vessels built in Japan for the United States Government. The description of the first ship, *Eastern Merchant*, given herein will be sufficient to give a general idea of both ships.

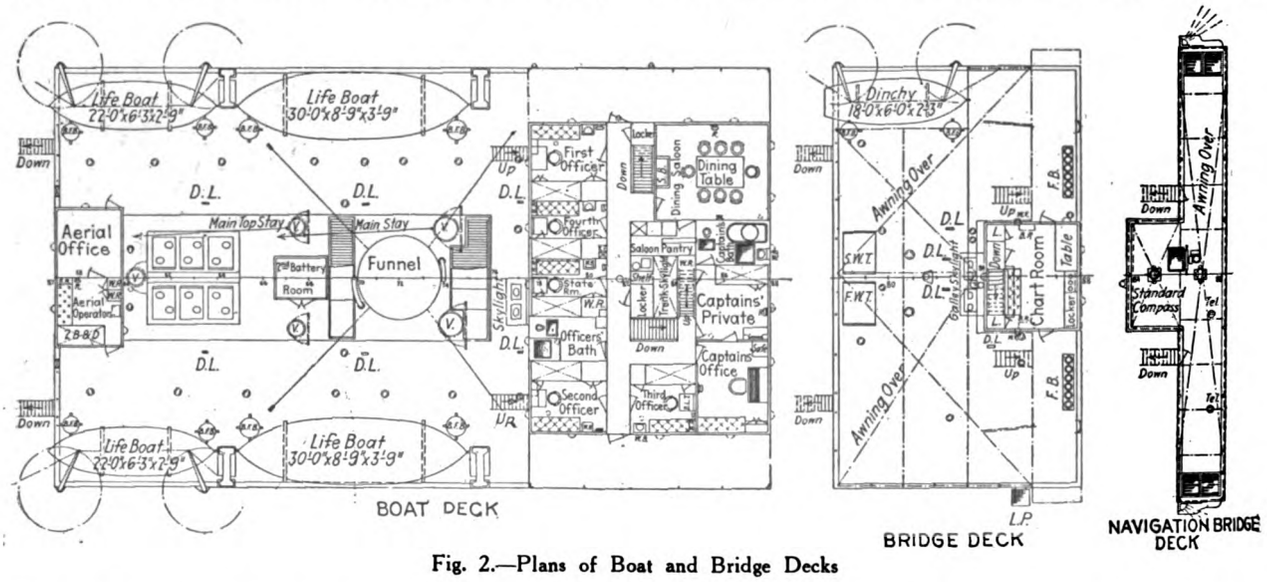

Fig. 2.—Plans of Boat and Bridge Decks

Principal Dimensions

The principal particulars of the *Eastern Merchant* are as follows:

Length overall	461 feet 7 inches
Length between perpendiculars	445 feet 0 inches
Breadth, molded	58 feet 0 inches
Depth, molded to shelter deck	40 feet 1 inch
Load draft	30 feet 4 inches
Gross tonnage	8,194 tons
Net tonnage	4,988 tons
Deadweight capacity	13,000 tons
Capacity for bale cargo at 40 cubic feet	14,000 tons

General Arrangement

The general arrangement is shown in the accompanying plans, from which it will be seen that the steamer is of the shelter deck type with three continuous decks, which are of steel throughout. Above the shelter deck there are steel deck houses to accommodate the officers and crew, the top of the midship house being extended to form a boat deck. There are seven steel watertight bulkheads, four of which extend to the shelter deck, and the others to the upper deck. A cellular double bottom extends the full length of the ship between the peak bulkheads, all of which will be used for the stowage of fuel oil, except the part under the engines, in which reserve feed water will be carried. The fore and aft peak tanks are also arranged for fuel oil. The total capacity of the fuel oil tanks, including the large settling tanks, is 1,768 tons, which will give the ship a steaming radius of about 11,000 miles.

Framing

The vessel is framed transversely, the frame spacing being generally 36 inches, reduced to 27 inches in No. 1 hold and to 24 inches in the peaks. Plate floors in the double bottoms are arranged on alternate frames, the intermediate floors being of bulb angle section, supported by flanged bracket plates. Widely spaced pillars of tubular section are arranged in the holds and tween decks, thus providing clear spacious holds for the storage of cargo. No side stringers are fitted except in the forward portion.

Accommodations

Accommodation for the officers and engineers is as shown on the illustration. The house on the boat deck is allotted exclusively for deck officers, the port side of the midship house for engineers, the starboard side for the steward and petty officers, and the after deck house for the exclusive use of the seamen and firemen, each quarter having a spacious and well equipped mess room. The saloon, captain's and chief engineer's cabins have been given special attention, the rooms being very tastefully finished in Japanese oak and pine. All officers' and crew's rooms are spacious, well ventilated and lighted and have been arranged to suit the special requirements of the American owners.

Cargo Handling Arrangements

The loading and discharging arrangements are of a very efficient character. Eighteen wooden derricks and one heavy steel derrick are provided to load and discharge cargo through six large hatchways, with the aid of 7-inch by 12-inch double geared horizontal steam winches. As will be seen in the accompanying plan, the two steam winches forward of No. 2 hatch are arranged for heavy lifts to work on a large lifting drum placed on the ship's centerline, through forged steel clutches, and with the topping arrangement leading to a similar drum connected to the No. 1 winches. This arrangement enables a quick and safe working of cargoes of large weights.

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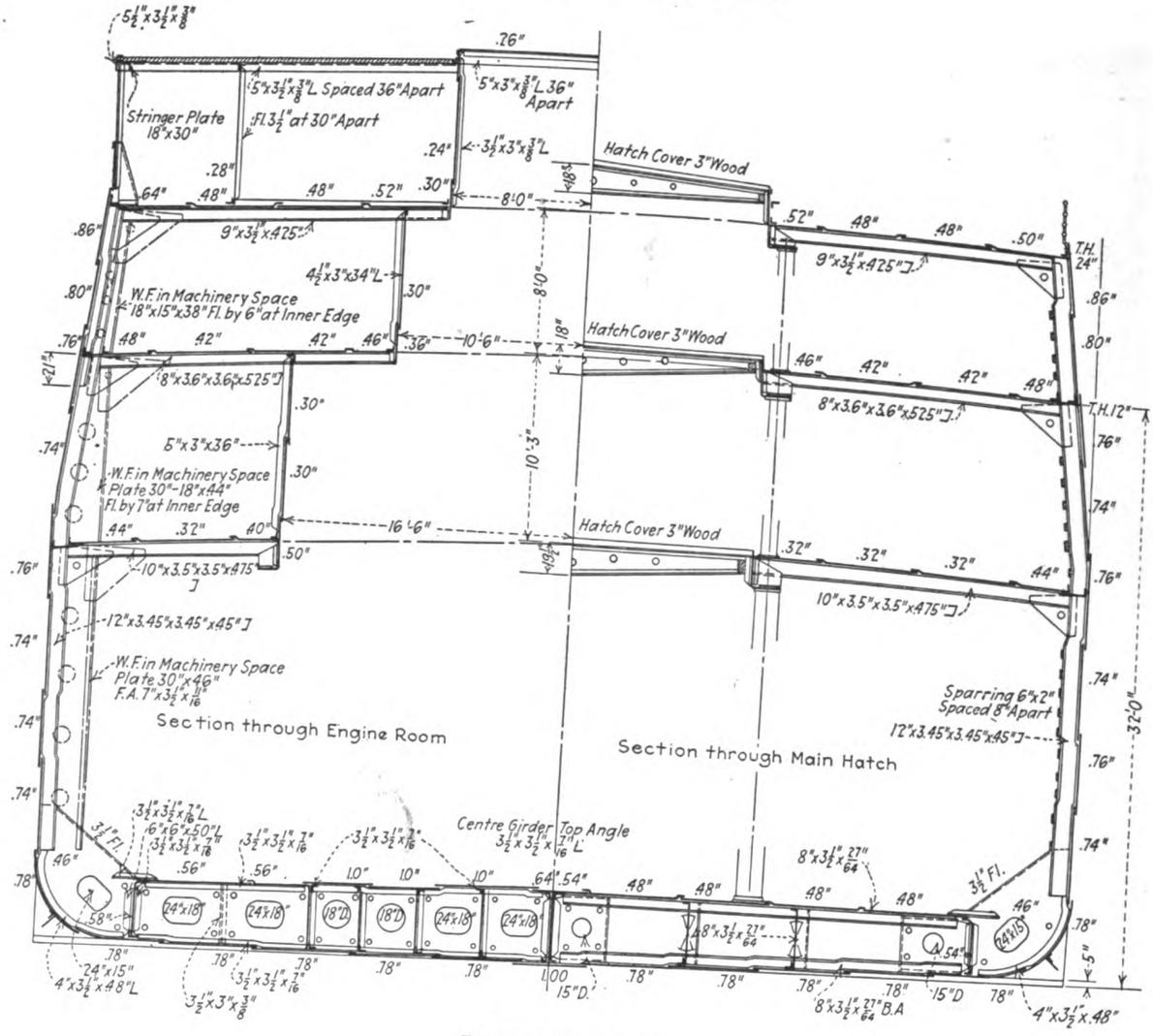

Fig. 4.—Midship Section

ANCHOR HANDLING

There is a powerful spur geared anchor windlass and a capstan engine aft for anchoring and mooring purposes. The bower anchors are of the Ohshima patent stockless pattern and are stowed in the hawse pipes.

STEERING GEAR

The steam steering engine is of Brown's patent steam tiller type actuated from the bridge through telemotor gears. An electrical rudder head telltale is provided so that any disturbance in the telemotor system can be readily noticed by the officer on watch. The ship has been arranged for the installation of wireless apparatus, but this has not been fitted by the shipbuilders.

PROPELLING MACHINERY

The propelling machinery of the ship consists of two sets of triple expansion engines, constructed by the Kubota Iron Works of Osaka. The particulars of each main engine are as follows:

Diameter of high pressure cylinder	22	inches
Diameter of intermediate pressure cylinder	36½	inches
Diameter of low pressure cylinder	61	inches
Stroke	48	inches

There are two main condensers, each having a cooling surface of 2,700 square feet. Each of the propellers has four detachable manganese bronze blades with a cast iron boss. The diameter and pitch of the propellers is 16 feet and 18 feet respectively.

Steam is generated by four single ended return tube boilers working under Howden's system of forced draft. The particulars of the boilers are as follows:

Diameter	14 feet 3	inches
Length	11 feet 6	inches
Working pressure	200	pounds per square inch
Grate area	58.2	square feet
Heating surface	2458.8	square feet

The engine and boiler room auxiliaries include the following:

Auxiliary condenser: One, of 600 square feet cooling surface.
Circulating pumps: Two sets, centrifugal type.
Independent feed pumps: One pair, size 10½ inches by 8 inches by 24 inches.
Independent bilge pump: One, size 6½ inches by 6½ inches by 6 inches.
Ballast pump: One, size 9 inches by 12 inches by 10 inches.
General service pump: One, size 10 inches by 6 inches by 10 inches.
Oil shifting pump: One, size 10 inches by 7 inches by 10 inches.

In addition, there is a 20-ton evaporator, an ash hoisting engine, a feed water heater, etc.

The ship is lighted throughout by electricity. Two dynamos, one of 25 kilowatts capacity and one of ten

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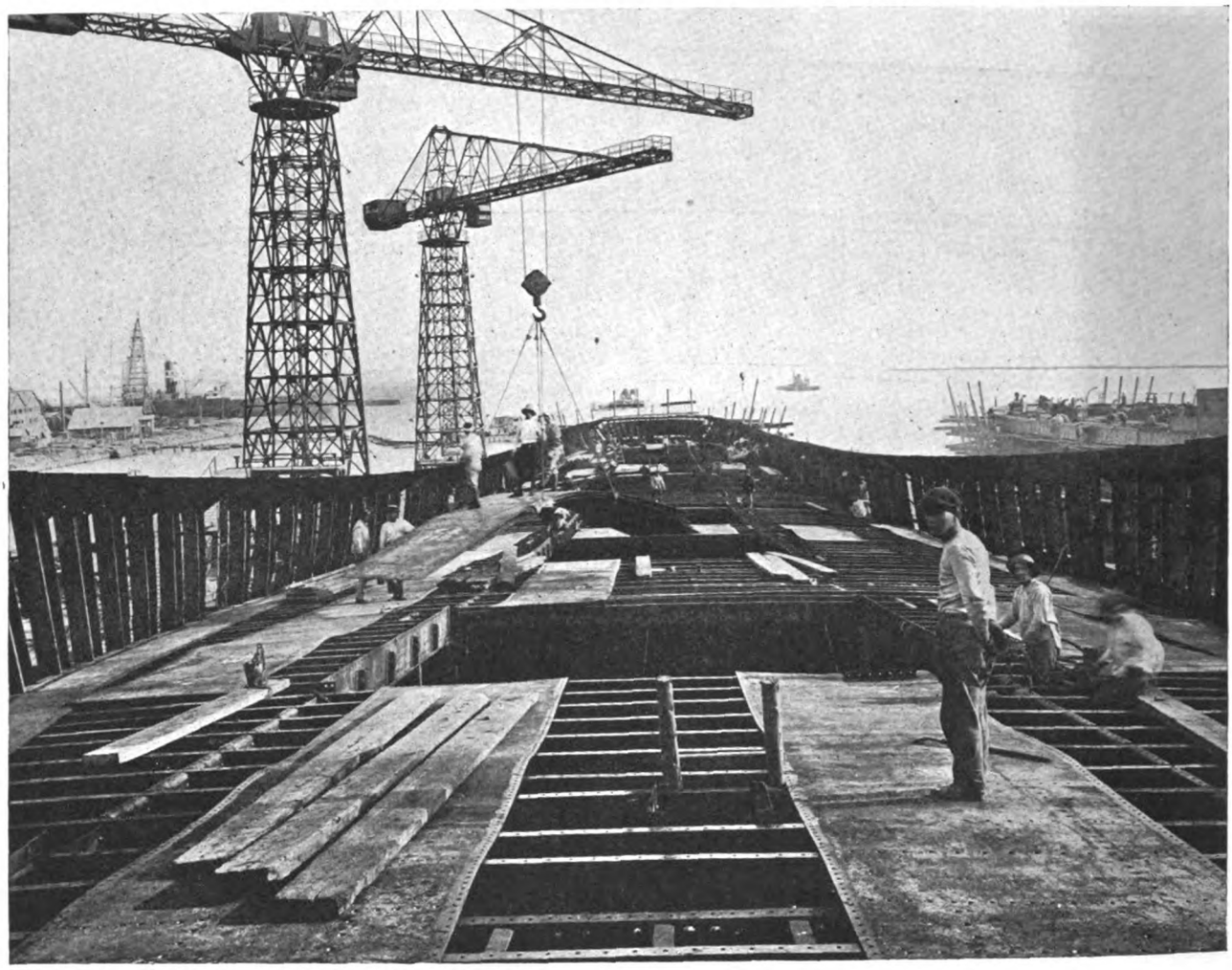

Fig. 5.—*Eastern Trader* Under Construction

kilowatts capacity, are placed in the engine room for this purpose. Space for cold storage and ice machines was provided, but these are to be installed in the United States after the vessel is delivered.

TRIALS

The steam trials of the *Eastern Merchant* and her sister ship *Eastern Trader* were very successful and satisfied both the owners and the shipbuilders. On the light load steam trial the *Eastern Merchant* attained a mean speed on double runs of 15.46 knots, while the *Eastern Trader* made 16.15 knots. Afterward the former ship easily made a mean of 12.7 knots on a six hours' continuous run with a total deadweight of over 11,000 tons on board, every part of the machinery being kept in normal working condition. Thus these ships proved themselves not only the largest but the fastest among the ships built in Japan for the United States Government.

The keel of the *Eastern Merchant* was laid on April 21, 1919, and that of the *Eastern Trader* on May 1, 1919. Both ships had several alterations during the construction, and were launched on October 6 and November 4 respectively. Both ships had steam trials during December of the same year and were handed over to the United States Government early in February, 1920, at San Francisco.

Steamship Eudunda Launched at Australian Naval Dockyard

A FURTHER stage in the progress of the Australian Commonwealth shipbuilding programme was reached on March 29 when the steamship *Eudunda* was launched from the Commonwealth Naval Dockyard, Cockatoo Island. This vessel is the first of the improved shelter deck type to take the water. Her principal dimensions are as follows:

Length between perpendiculars	331 feet 0 inches
Breadth, molded	47 feet 9 inches
Depth, molded to upper deck	26 feet 1 inch
Load draft	23 feet 8 inches
Indicated horsepower	2,300
Boilers (Babcock and Wilcox)	3
Speed	10½ knots

The vessel is built to Lloyd's classification on the Isherwood system of framing and has a double bottom extending from the forward collision bulkhead to the after peak. The double bottom, except under the boiler room, is arranged for stowage of oil fuel, it being anticipated that the vessel will be required to burn coal or oil during her period of service.

A complete shelter deck is fitted, thus adding considerably to the deadweight carrying capacity of the vessel,

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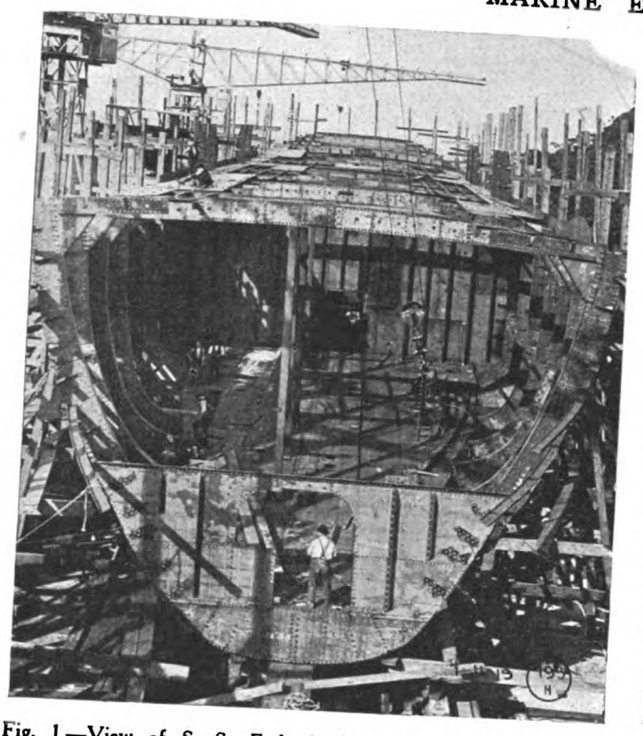

Fig. 1.—View of S. S. *Eudunda* in Course of Construction at Commonwealth Naval Dockyard, N. S. W.

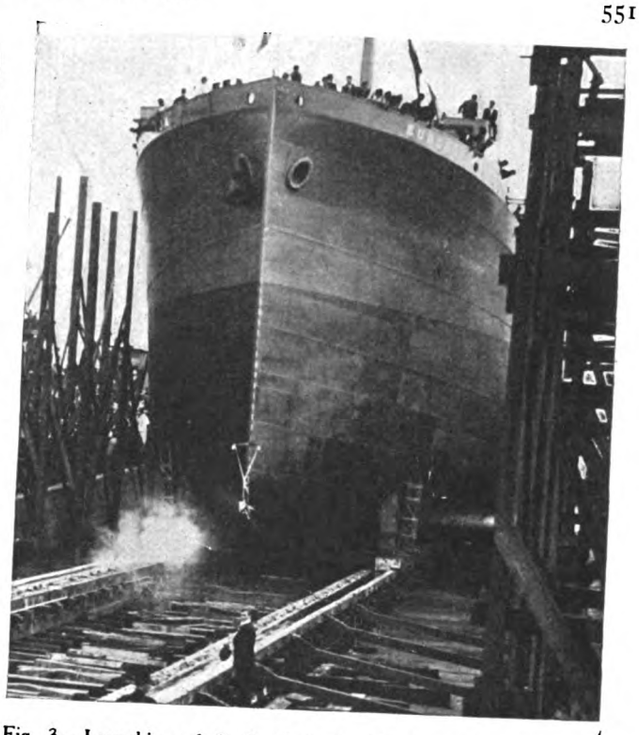

Fig. 3.—Launching of S. S. *Eudunda*, Naval Dockyard, Sydney, N. S. W., on March 29, 1920

which now becomes 6,000 tons as against 5,500 in the earlier vessels.

Accommodations throughout are arranged in accordance with the latest requirements of the Navigation Act. The officers' quarters are on the bridge deck. The captain's quarters with the wireless operator's and wireless room, are on the lower flying bridge. The seamen and firemen are berthed aft on the upper deck. The joiner work is of Australian timber and all fittings are first class throughout.

A refrigerating room for carrying of food supplies for the ship's company is installed on the upper deck. The vessel is lighted throughout with electricity and all cabins are steam heated. The piping arrangements are very complete and include an efficient system for dealing with the oil fuel.

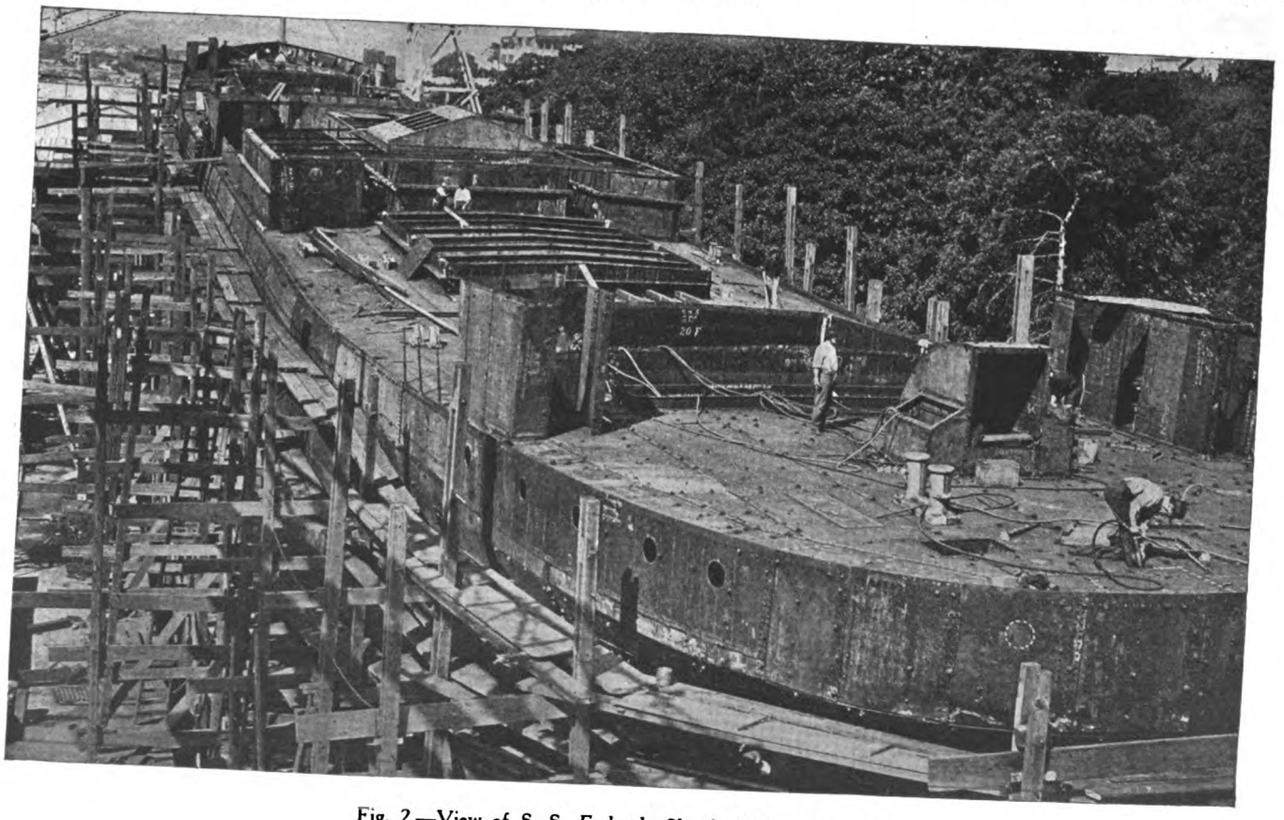

Fig. 2.—View of S. S. *Eudunda* Shortly Before Launching

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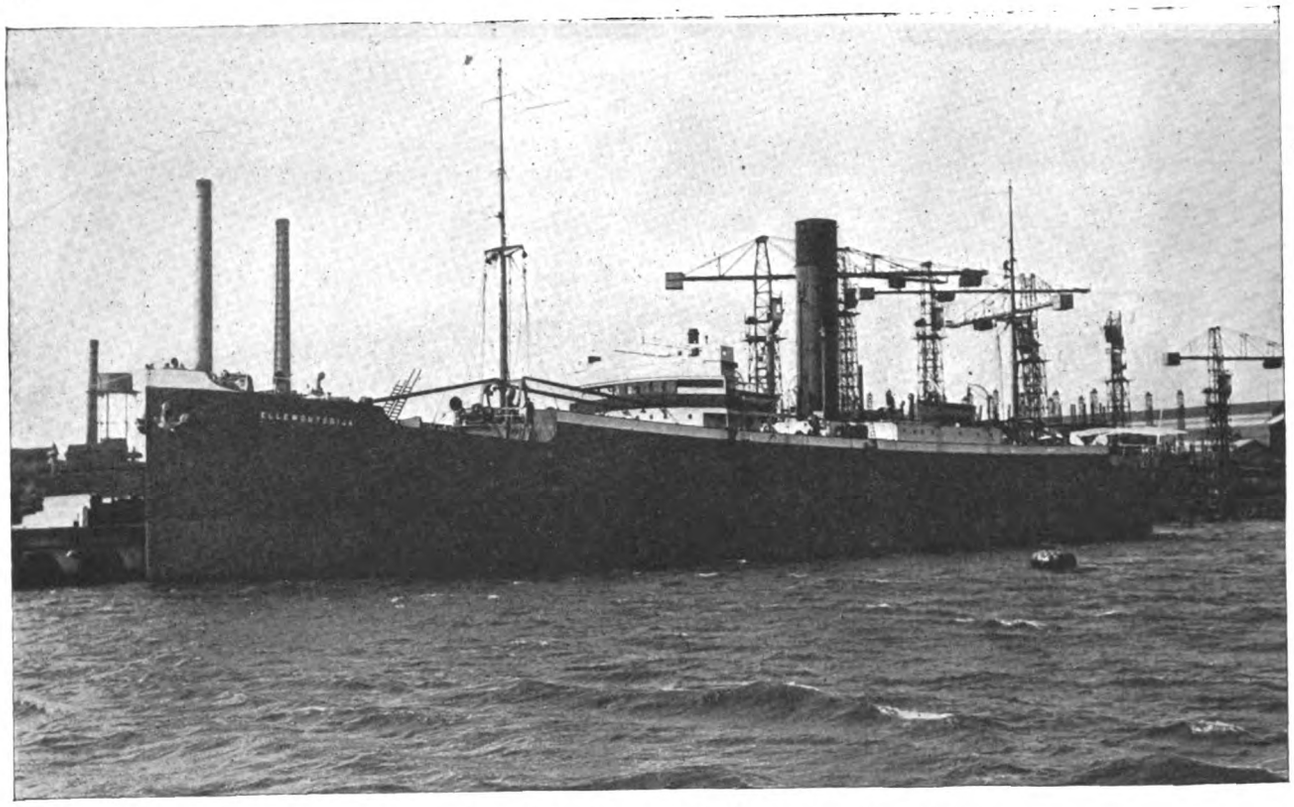

S. S. *Ellewoutsdyk*, Built at Werf Gusto Works, Schiedam, Holland

Cargo is handled by eight 5-ton steel lattice work derricks carried on the foremast and mainmast and a 20-ton steel derrick, which is provided for dealing with heavy weights. Eleven steam winches are fitted, viz., eight 7-inch by 12-inch winches at main cargo hatches; one 7-inch by 12-inch winch aft, having an extended main shaft with couplings and brackets and fitted with warping drums, and two 7-inch by 12-inch winches amidships for the cross bunker hatch.

It is interesting to note that these winches, together with the windlass, steam steering gear and other auxiliary machinery and fittings are of Australian manufacture, the winches and windlass being supplied by the Perry Engineering Company, of Adelaide, and the steam steering gear by Messrs. P. Jorgenson & Sons, Bendigo. The manufacturers of the refrigerating machinery are Messrs. Wildridge and Sinclair, Ltd., of Sydney, and various makers throughout the Commonwealth are supplying the remainder of the equipment.

The engines are of the usual triple expansion vertical marine type, developing 2,300 indicated horsepower, manufactured by Messrs. Thompson & Company, of Castlemaine, Victoria. There are three Babcock and Wilcox boilers, having a heating surface of about 8,000 square feet.

New Dutch Steamship

THE latest vessel turned out by the Werf Gusto Firma A. F. Smulders, Schiedam, Holland, is the cargo steamer *Ellewoutsdyk* built for Messrs. Solleveld vander Meer & T. H. van Hattum's Steamship Company, Rotterdam. The *Ellewoutsdyk* is a single deck vessel with long bridge and poop, built according to the highest classification of Lloyd's, 100 A-1, under the supervision of the Dutch shipping and harbor authorities. She has a length of 359 feet 3 inches, a beam of 50 feet, and a depth of 24 feet 6 inches. On a draft of 21 feet 7½ inches the vessel has a deadweight carrying capacity of 6,300 tons, her gross tonnage being 3,683, and the net tonnage 2,239.

Six watertight bulkheads divide the hull into seven compartments, four of which are cargo holds. The capacity of each is as follows:

	Grain, Cubic Feet	Bales, Cubic Feet
Hold 1	76,950	71,630
Hold 2	96,570	90,530
Hold 3	58,690	54,730
Hold 4	47,820	43,330
Bridge, forward of casing	42,170	36,880
Bridge, at side of casing	10,460	8,220
Bridge, aft of casing	25,620	22,320
Forecastle	6,070	5,220
Total capacity	364,350	332,860

The bunkering capacity is 793 tons, including the spare bunker under the bridge. The capacity of the water ballast tanks, including the fore and aft peaks, is 1,130 tons.

Officers' quarters are situated under the bridge and above or along the engine casing. The crew is berthed in the poop. Separate hospitals are provided for the officers and crew.

The vessel is propelled by a triple expansion engine with cylinders 25 inches, 41 inches and 67 inches diameter by 45 inches stroke, designed to develop 1,800 indicated horsepower. Steam is supplied at a pressure of 180 pounds per square inch by three coal-fired Scotch boilers, each 13 feet 9 inches diameter by 10 feet 5 inches long. Both propelling and auxiliary machinery were manufactured at the Werf Gusto works. The auxiliaries include an electric generating set of 7 kilowatts capacity, which provides current for lighting the vessel and also for the wireless equipment.

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Passenger Steamer for the Newcastle-Bergen Route

AN important event in the progress of British reconstructive shipbuilding took place on May 4 at the Walker shipyard of Messrs. Sir W. G. Armstrong, Whitworth & Company, Limited, of Newcastle-on-Tyne, when a steel screw passenger vessel for Det Bergenske Dampskibsselskab, Bergen, was launched. Mrs. Lee, Lady Mayoress of Newcastle-on-Tyne, gracefully named the vessel S. S. *Leda*. The *Leda*, which is to run between Newcastle and Bergen, forms a powerful addition to the company's fleet. She is a finely modelled steamer with slightly larger accommodation and more speed than the S. S. *Jupiter*, which up to the present has been the fastest steamer in this service.

The principal dimensions are as follows:

Length overall	321 feet 2½ inches
Length between perpendiculars	305 feet 0 inches
Breadth, extreme	41 feet 9 inches
Depth, molded	20 feet 6 inches
Mean load draft	17 feet 0 inches

The vessel is of the two deck type, with combined poop and bridge, joined to the forecastle by means of two permanent gangways, the shell being carried up in way of the forward well to the line of the forecastle. A promenade deck extends for about one-half length amidships, covering the midship house, while above this is the boat deck, at the fore end of which is placed a house containing the accommodation for the captain and principal deck officers. An after boat deck covers the house containing the steering gear, third class entrance and seamen's entrance.

Passenger Accommodations

The vessel is fitted out for about 100 first class passengers, in one and two-berth rooms, placed on the upper and second decks. These staterooms, which are large and airy, are fitted up in first class style and are in every way suitable for the comfort of the passengers. A large dining saloon is fitted up at the fore end of the bridge deck, having seating accommodation for all passengers. The main entrance of this dining saloon is carried up to the promenade deck, from which opens a spacious lounge. The decorative work and fittings of the saloon, lounge and entrances are of elegant finish, the work being designed and carried out by Messrs. Trollope & Colls, Ltd., of Liverpool. The whole of the first class accommodation is such as will appeal strongly to those crossing from Great Britain to Norway.

On the upper deck aft, accommodation is arranged for forty-seven third class passengers in two, four, five and six-berth cabins, with two comfortable dining rooms, one on the upper deck, the other in the house on the poop deck. An open air café is arranged at the aft end of the promenade deck.

Officers' and Crew's Quarters

On the bridge deck around the engine and boiler casing are housed the engineers and junior deck officers; here also are the mail room, post office, etc. Accommodation for the stewards and stewardesses is arranged at the after end of the first class accommodation on the upper deck. The firemen are berthed on the second deck at the sides of the engine casing, and the seamen on the second deck aft.

Construction and Equipment

The vessel is built to the highest class of Norske Veritas and will be the first vessel in the North Sea to comply with the requirements of the London Convention for Safety of Life at Sea. The regulations of the Norwegian Board of Trade for passenger vessels have also been complied with. Ample water ballast capacity is arranged for in double bottom, deep tanks, side tanks and fore and aft peaks, ensuring an equally good sea boat in the loaded condition. Three cargo holds are arranged, each served by double derricks and double winches, so that cargo can be quickly shipped and unshipped. The ventilation arrangements are of the most up-to-date type. The first and third class accommodation, seamen's and firemen's accommodation are ventilated and heated on the thermo tank system and arranged so that the air in each room may be continuously changed. Special insulation is fitted to keep the various rooms at a uniform temperature in the coldest weather, and also to guard against overheating from the machinery and boilers.

The deck machinery is of the latest type, the steering gear of Caldwell's make being fitted on the rudder head, with telemotor control from the wheelhouse amidships. The vessel is fitted with electric light throughout, having duplicate plants, together with emergency lighting and pumping arrangements, as required by the London Convention. Marconi wireless installation is also fitted. The cooking and serving arrangements are of the very best description, designed so that food can be well and quickly served. The various regulations to guard against fire are being fulfilled, while lifesaving appliances are in accordance with the latest requirements of passenger vessels. Lifeboat accommodation is arranged for every person on board.

Propelling Machinery

This vessel is of the single screw type, with turbine machinery driving the propeller shafting through gearing. The turbines consist, for going both ahead and astern, of a high and low pressure turbine, working in series. These turbines transmit their power through flexible couplings to pinions, which in turn drive the gearing, which is of the double reduction type. This type of gearing makes possible a speed of rotation which is best suited both to the turbines and the propeller, resulting in a high overall efficiency being obtained. At the same time, the revolutions of the propeller are about the same as would be obtained by machinery of the reciprocating type, the total reduction of speed between the turbines and propeller being effected in two steps.

When working at full power on service it is anticipated that the turbines will develop about 2,800 shaft horsepower at about 115 revolutions per minute. The impulse type of turbine having wheel stages throughout has been adopted; the grouping is such as to produce practically an equal transmission of power through the high and low pressure turbines. The adoption of high and low pressure turbines for going astern produces an arrangement which is conducive alike towards greater efficiency and immunity against total breakdown. The rotating portions of the turbines comprising the stage wheels and the spindles have been made entirely from ingot steel forgings, while the blading throughout is of phosphor bronze material.

The gear wheels and pinions are of the double helical type, the shape, size and pitch of teeth being made in accordance with what experience has proved to be satisfactory. The wheel rims upon which the teeth are cut, together with the main shafts, are made from ingot steel forgings, while the pinions are of nickel steel.

Lubrication and Auxiliaries

For the efficient and silent running of such gearing it is necessary that the means of lubrication should be as thorough as possible. For this purpose sprayer nozzles, distributed at suitable intervals, are arranged to spray

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the oil direct onto the engaging teeth, thereby providing a film of oil between the surfaces in contact. All other bearings in connection with the turbines and gearing also work under a system of forced lubrication.

The Michel type of thrust bearing is used both in connection with the adjusting of the high and low pressure turbines and the main thrust block.

The condensing plant is made capable of maintaining a vacuum of 28½ inches, with the temperature of sea water at 60 degrees F. when the machinery is developing its full service power. A very complete installation of auxiliary machinery is provided to cope with the whole of the engine room and deck requirements of a vessel of this class. This includes an auxiliary condenser of suitable size.

BOILERS

The boilers are of the multitubular type, single ended and three in number. They are arranged for working with Howden's system of forced draft. The working pressure of the boilers is 220 pounds per square inch. An approved type of superheater is fitted in connection with the boilers, and the temperature of the superheated steam entering the turbines is about 200 degrees F. in excess of saturated steam. Special attention has been paid to the provision of suitable materials which come in contact with the superheated steam, both in the boiler and engine rooms, and considerable attention has been given to the insulating of all hot surfaces, by the provision and application of special non-conducting materials. A fan arranged for driving by two engines, one being a stand-by, is fitted for supplying the air for the forced draft. The stack is of oval section with outer casing, which is carried the full height.

Ample and well directed ventilation is provided for both the engine and boiler rooms. The machinery throughout has been built to the Norwegian Veritas classification for a passenger vessel, and it also complies with the requirements of the London convention. The new vessel will be a great acquisition to the owners' fleet, and will without doubt rapidly become popular with the traveling public.

Vessels of the Forest Lumber Fleet

Five-Masted Barkentine Rigged Sailing Vessels, Especially Designed for Lumber Trade, Being Built in Pacific Coast Yards

THE wooden sailing vessel, because of its comparatively low operating cost, still has a section of the carrying trade almost exclusively for its own. Where the time element does not enter the question of transporting a cargo, the sailing vessel enters the field in fair competition with the steam- and the motor-driven ship. In the case of lumber carrying, this fact is particularly true, and many ships are at present building along the Pacific Coast to engage almost entirely in this traffic.

Recognizing the commercial value of the sailing vessel in the lumber-carrying trade, the Forest Line, controlled by the Grays Harbor Motorship Corporation, Aberdeen, Wash., has recently added to its fleet several of what are considered the last word in wind-jammer freighters.

The vessels were designed by M. R. Ward, the vice-president and general manager of the corporation, who during the war produced what was known as the "Ward Type" ship, one of the most efficient of the wooden vessel types adopted by the Emergency Fleet Corporation. The design is the result of a careful balancing of the various requirements of a lumber-carrying vessel which have been found by experience necessary in this trade.

GENERAL DETAILS OF CONSTRUCTION

Among other notable deviations from general practice in construction, the design incorporates a series of steel reinforcing frames at the turn of the bilge. These reinforcements, consisting of ¾-inch by 14-inch steel plates averaging 13 feet in length, are placed on every third frame for about three-fourths of the vessel's length. For final installation the plates are bent to the proper curvature and bolted through the wooden frames. To further strengthen the members, 6-inch by 6-inch by ½-inch angle irons are riveted to the steel plate, and after the vessel is ceiled a ½-inch strap is bolted through the ceiling to the angle irons by means of two bolts in each strake.

The Ward design also includes an arch keelson built up to the height of the 'tween decks. Both the above features contribute materially in reducing the weight of the other members entering into the construction of the hull, thus increasing both the bulk and deadweight carrying capacity of the vessels.

MACHINERY INSTALLED

There is one winch in the donkey house forward of hatch No. 1, mounted on the same frame with a specially constructed Lloyd's tested 54-inch donkey boiler. There is also one winch forward of hatch No. 2. With this handling gear very fast time for a sailing vessel can be attained in handling lumber; in fact, in loading the *Forest Pride*, a vessel of the type described above, it was demonstrated that under reasonably favorable conditions as much as 200,000 board feet of lumber could be loaded in eight hours.

Mounted athwart the top of the donkey house, at the after end, is a 3 15/16-inch shaft carrying two gypsy heads, which can be driven either from the winch in the donkey house or from a 12-horsepower standard distillate engine, through a specially constructed reduction gear. The gear ratio between the engine shaft and the gypsy shaft is eight to one, giving a speed of about 40 revolutions per minute on the heads when the engine is turning at its rated speed. This results in a purchase at the gypsy heads that makes possible the handling of the heaviest loads, even to weighing the anchors. In utilizing the heads for this purpose in an emergency it is necessary to connect them to the windlass by means of a messenger chain. The distillate engine is also used to drive a Liverpool pump installed just aft of the engine house, connection also being made through a messenger chain.

An ample water supply is provided in the form of two 3,000-gallon tanks placed on the 'tween decks, just aft of the chain locker, and immediately aft of these is located a 6-inch by 4-inch by 6-inch duplex general service steam pump, which may be used for pumping bilge or for fire protection. This pump is reached from a hatch located in the sailors' quarters in the forecastle. Between hatches 2 and 3 two hand deck pumps with cylinders 7 inches by 5 inches are installed as low as possible. There is also one portable hand deck pump provided with the necessary

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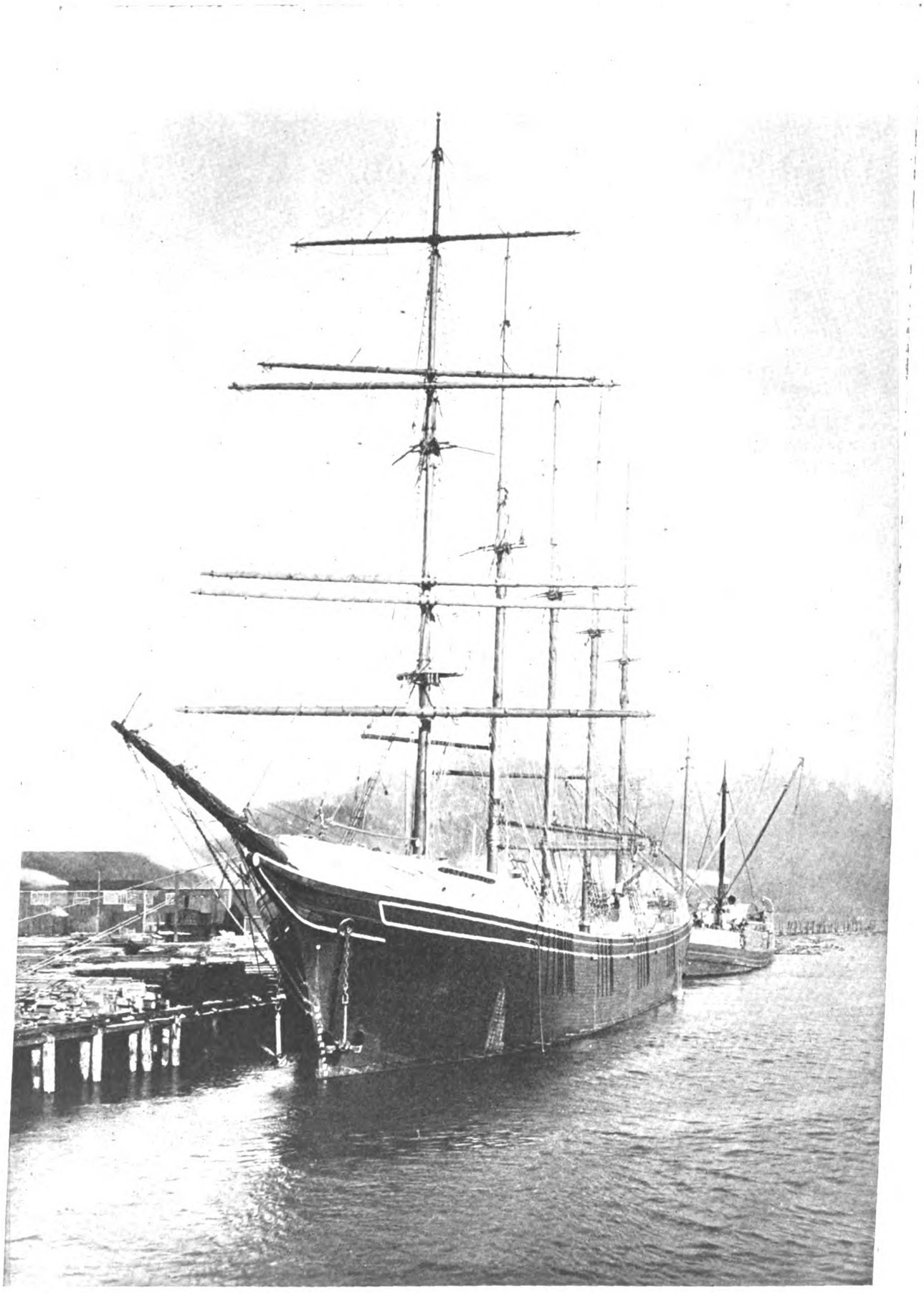

Barkentine-Rigged Ship *Forest Pride* Built for the Lumber-Carrying Trade Between Pacific Coast Ports and the Far East

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Marine Construction News of the Month

Ship Contracts—New Ship Concerns and Shipyard Improvements—Terminal Projects—Government Contracts

SHIP CONTRACTS

Freighters, Ecorse, Mich.—The Great Lakes Engineering Works has prepared designs and plans for at least ten new freighters which will probably be built this summer.

Freighters, Manitowoc, Wis.—The Manitowoc Shipbuilding Company will build five 3,300 tons deadweight freighters for its own account, keels for which will be laid immediately.

Barkentines, Victoria, B. C.—Building of four wooden barkentines will be begun soon by the Victoria Ship Owners, Ltd., of Victoria, B. C. They will be 2,500 tons each, and will cost $250,000 each.

Tankers, Portland, Oregon.—The Northwest Steel Company, Portland, will build seven 12,000-ton tankers for the Swift Sure Oil Tank Transport Company. J. R. Bowles is president of the steel company.

Steamers, Pacific Coast.—Announcement is made that H. F. Alexander, president of the Pacific Steamship Company, is making inquiries regarding moderate sized steamers for operation on the Pacific Coast.

Steamers, China.—Orders for five steamers have been placed by the China Merchants Steam Navigation Company. Four will be built in Chinese yards and the other in a British yard. Details not yet available.

Tanker, Seattle.—The Skinner & Eddy Shipbuilding Company received a contract rfo two 13,500 ton oil tankers for Norwegian interests, requiring ten months to build. A 3,600 horsepower engine will be installed.

Passenger Steamers.—The New York & Porto Rico Steamship Company has had two 400-foot steamers designed by Theodore Ferris for passenger and freight service, and it is expected that bids will be asked for very soon.

Barkentines, Seattle, Wash.—The Frank W. Haviside Company, of Seattle, Wash., has purchased two of the big Ferris-type hulls built at Eureka, Calif., from the Shipping Board, and will completo them as five-masted barkentines.

Tankors, Pascagoula, Miss.—Negotiations are in progress for the building of six tankers at the National Shipbuilding Company's plant. The steamers will be of 3,800 to 4,000 net tons, and used in the Texas-Mexico oil trade.

Tankers, Sparrow's Point.—It is reported that two bulk oil carriers, of about 10,000 tons each, have been ordered by French interests from the Bethlehem Shipbuilding Corporation, Ltd. They will probably be built at the Sparrow's Point plant.

Cargo Steamers, Glasgow, Scotland.—The Cork Steamship Company, Ltd., have placed an order with Ferguson Brothers, Port Glasgow, for three steamers for the continental cargo trade. Swan, Hunter & Wigham Richardson, Ltd., are building four vessels for the same company.

Freighters, Norwegian-American Line.—Four new freighters for the Norwegian-American Line are being built by Napier & Miller at Glasgow, Scotland. Two are of 9,500 tons, and two of 7,500 tons. The Canadian Vickers, at Montreal, are building two 6,500-ton steamers for the same line.

Ice Breaker, St. Lawrence River.—The Canadian Department of Marine, Ottawa, Canada, has authorized the construction of an ice breaker for use on the St. Lawrence river. The vessel is to have 8,000 horsepower, will carry a crew of 90 men, and the estimated cost is $2,000,000.

Tankers, Orange, Texas.—The National Shipbuilding Company, of Orange, Texas, has purchased five of the Ferris-type ships at the plant of the Beaumont Shipbuilding & Dry Dock Company, Beaumont, Texas, will have them planked with creosote sheathing, and install tanks for their use in the oil trade.

Tankers, Everett, Wash.—The Norway Pacific Shipbuilding Company has received contracts for seven oil tankers and six oil storage basins to cost approximately $20,000,000. Five tankers will be of 10,000, and the other two 3,500 tons each. The storage basins will have a capacity of 300,000 barrels.

Steel Barges, Newark, N. J.—The Submarine Boat Corporation, has inaugurated construction of small cargo carrying all steel barges. The first fleet to be built will be used for canal service between Buffalo and New York. They will be built similar to the large fabricated steel vessels built for the Government.

Fruit Steamer, Newburgh, N. Y.—The keel for another ship for the Cuyamel Fruit Company has been laid at the Newburgh, N. Y., Shipyards. The vessel will be 301 feet 6 inches between perpendiculars, molded beam 42 feet, molded depth 25 feet, with twin screw reciprocating engines and three Scotch boilers, giving a speed of 14½ knots.

Tanker, Chester, Pa.—The Norwegian-American Line has placed an order with the Sun Shipbuilding Company Chester, Pa., for a 10,600-ton tanker, 430 feet long, 59 feet beam, 33 feet 3 inches deep, triple expansion engines, Scotch boilers, and with a speed of 10½ knots on a consumption of 30 tons of fuel oil daily. She will be built on the Isherwood system.

Passenger Liner, Camden, N. J.—The Munson Steamship Line, 82 Beaver street, New York, has placed a contract with the New York Shipbuilding Company, Camden, N. J., for a 15½-knot passenger liner of 6,000 tons gross register, oil burning, with steam turbine engines, and fitted especially for tropical service. The cost will be between $2,500,000 and $3,000,000.

Tanker, Camden, N. J.—The Sun Shipbuilding Company has received a contract from French interests for a 6,600-deadweight tank steamer. The name of the company ordering the steamer has not been made public. The Sun Company recently launched a steamer which was the first contract taken by an American yard from a foreign country after the armistice was signed.

Tankers and Barges, Bath, Maine.—The Texas Company has placed an order with the Texas Steamship Company for two 9,500-ton steel tank steamers, duplicating other vessels built at the company's yard, except that Scotch boilers will be installed; also for three steel harbor barges each with a capacity of 7,500 barrels of heavy Mexican oil. These barges are to be fitted with Scotch boilers to supply steam for operating cargo pumps, heaters, etc. The Carnegie Steel Company has the contract for the material involved.

Ore Steamer, Fore River.—The steamer Cubore, building at the Fore River plant of the Bethlehem Shipbuilding Corporation, Ltd., to be used in bringing ore from Cuba, will be of 11,400 tons deaweight, is 468 feet over all, 57 feet beam, 27 feet draft. She will be equipped with a 2,500-horsepower Diesel engine, and will have a speed of 10 knots loaded. In addition to the usual ballast tanks she will have side tanks, making practically a double hull, and six big hatches, allowing her to load in five and a half hours.

Passenger Vessels, Glasgow, Scotland.—In connection with the program for the extension of the fleet of the Nippon Yusen Kaisha (Japan Mail Steamship Company), Tokyo, William Denny & Bros., Ltd., of Dumbarton, have received from that company orders for two vessels, each 395 feet long and about 5,000 gross tons. These vessels are for fast passenger service, with a speed of 18½ knots. They will be built under the supervision of A. R. Brown, MacFarlane & Company, Ltd., the company's Glasgow agents.

Tanker, Staten Island, N. Y.—The Staten Island Shipbuilding Company will build for the American Sugar Refining Company, of New Jersey, a 6,300 deadweight ton steel combination bulk molasses and oil tanker; estimated cost $1,500,000. Dimensions: Length, 360 feet; molded breadth 50 feet, and molded depth, 29 feet. The vessel will be of steel, single-screw type, with straight stem and elliptical stern, built on the longitudinal system of framing, with two steel decks, raised poop, forecastle, bridge, with bridge house over house on poop deck. The machinery will be located aft. The pump room will be forward of the boiler room. There will be a double bottom under the machinery space with compartments for carrying feed water. The ship will be able to carry cargo in some of its compartments. The hold will be divided into six tanks, for oil or molasses in bulk, with a fuel tank between cargo tanks Nos. 3 and 4.

SHIPYARDS AND DRYDOCKS

Drydock, New Orleans, La.—The Jahncke Dry Dock & Ship Repair Company, New Orleans, will equip a third drydock with a lifting capacity of 6,000 tons.

Drydock, Seaford, Del.—The Delaware River Shipbuilding & Repair Company has placed a contract with the Crandall Engineering Company, of Boston, for the construction of a 3,000-ton dry dock at its Seaford, Del., yard.

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Shop, Fairfield, Md.—A permit for the construction of a one-story shop, 60 by 400 feet to cost $67,000 has been granted to the Globe Shipbuilding & Dry Docks Company, which is building a plant at Fairfield, Baltimore.

Steel Shop, Quincy, Mass.—The Bethlehem Shipbuilding Corporation Ltd., has awarded a contract to Snare & Triest, 8 West 40th street, New York, for a three-story concrete steel shop addition to its Fore River (Mass.) plant, to cost about $75,000.

Schooner, East Boothbay, Maine.—At the Adams yard a schooner of 105 feet keel, to be used for trading purposes between San Francisco and the South Sea Islands, will be ready for launching in June, and will be equipped with a Standard 45 H. P. engine.

Cargo Carrier Launched, Bath, Maine.—The Texas Steamship Company on May 1 launched the 10,000-ton cargo carrier Occidental at its Bath, Me., yard. The company has two more 10,000-ton ships on the ways, and more vessels to build as fast as the ways are vacated.

Marine Railway, Portland, Ore.—Supple & Martin are planning a marine railway for their shipbuilding plant at Linnton. The railway is to be provided with laterals, which will bring ships to be shunted to the machine shops and sawmill. The new device is expected to lift a vessel out of the water in thirty minutes.

Shipyard Sold, Portland, Oregon.—The Northwest Steel Company, Portland, ha sold its shipbuilding plant to the Northwest Bridge & Iron Company, a new organization. Contracts recently awarded to the Northwest Steel Company for seven 12,000-ton steel tankers by the United States Shipping Board were also taken over.

Marine Railway, Boothbay Harbor, Maine.—The Atlantic Coast Company, owned principally by Crowell & Thurlow, of Boston, is soon to begin building a marine railway capable of hauling out vessels of more than 2,000 tons, at its Boothbay Harbor yard. At present there are two 1,200 four-masted schooners at the yard, which will be launched this fall.

New Yard, Sturgeon Bay, Wis.—Joseph Wolters, who sold his shipyards at Sturgeon Bay to the Universal Shipbuilding Company two years ago, plans to build a new yard which will have one of the largest floating drydocks on the lakes. Prominent men in the shipping interests of that section of the lakes are financially interested in the project.

Tankers, Port Jefferson, L. I., N. Y.—The Bayles Shipyard at Port Jefferson, Long Island, which has been taken over by the New York Harbor Dry Dock Company, has launched the tanker Anahuac She is of 1,200 tons displacement, 180 feet long, 31 feet beam, 16 feet depth, with a capacity of 7,000 barrels, and was built for the Nyack Shipbuilding Company. A 3,500-ton ship will be launched on June 2.

New Shipyard, Algiers, Africa.—A company is forming at Algiers for the purpose of erecting a shipbuilding plant. According to reports three slips will be constructed at Fort de L'Eau, in the center of the Bay of Algiers, and it is hoped during the first year of the company's existence to complete the hulls of three vessels of 3,000 to 3,500 tons each. It is proposed to build the hulls only in Algeria.

Manila Dock Merger, H. I.—The Honolulu Iron Works, a Hawaiian firm, and Earnshaw's Slipways & Engineering Company, a Philippines concern, have been merged into a corportion known as Earnshaw's Dock & Honolulu Iron Works, which among other things, will operate a large dry dock and ship repairing establishment. At present about 2,000 men are employed in ship docking and repairing.

Fruit Steamer, Staten Island, N. Y.—The Standard Shipbuilding Corporation launched the first of two fruit steamers built for the Cuyamel Fruit Company, of New Orleans, on Saturday, May 8. The vessel is named the Hibueras, and is a special type combination passenger and cargo steamer, 235 feet long, 34 feet beam, 16 feet deep. The company is also constructing four 8,800-ton of the "gold shell" type, for the Eagle Oil Transportation Company, of London, England.

Freight Terminal, Greenville, N. J.—The Lehigh Valley Railroad plans three piers, to be known as the Claremont piers, at its terminal in Greenville. The first half of one of the piers about to be built will be 3,000 feet long, and each of the three piers when built will be 7,000 feet long. They will provide six miles of dock space with open and warehouse storage facilities and all modern features. The piers will be 400, 350 and 300 feet wide, with slips 500 feet wide at the pier heads, tapering to a maximum inshore width of 450 feet. The first unit will replace the Lehigh Valley's ore dock at Constable Hook, and the whole operation will require 12,000,000 cubic yards of dredging.

PORT IMPROVEMENTS

Bulkheads, Miami, Fla.—The Alton Beach Realty Company plans to construct 2½ and 2-mile bulkheads at Miami, Fla.

Pier, Marcus Hook, Philadelphia.—The Sun Oil Company plans to build a pier at its property at Marcus Hook. It will be a solid structure, 520 feet long and 200 feet wide.

Wharf, West Norfolk, Va.—S. G. Williams & Company has been awarded contract to build a wharf for Hastings Brothers, stevedores, at West Norfolk, Va., estimated cost $25,000.

Sea Wall, Boston, Mass.—City has let contract for building 1,350 foot concrete sea wall and back fill at Albany street, to N. S. Rendle, 364 Border street, East Boston, Mass. $200,823.

Piers, New York.—Bids will be received until June 2 by Murray Hulbert, Commissioner of Docks, Pier A, North River, for building piers at Stanton street, East River. About $200,000.

Dredging and Repairing Pier, New York.—The city has begun the work of dredging and repairing at Pier 72, at East 24th street, to cost about $90,000. When the work is completed the pier will be leased to the highest bidder.

Pier, New York City.—Murray Hulbert, Commissioner of Docks, Pier A, North river, has let contract for lumber pier and freight shed at 5th street, East river, to Associated Contractors Corporation, 17 West 42nd street. $122,790.

Pier, Jersey City, N. J.—Henry Steers, Inc., 17 Battery Place, New York City, has been awarded contract to build a pier and channel warehouse at Jersey City for the Claremont Terminal, Lehigh Valley Railroad, of 143 Liberty street, New York City.

Breakwater, Toronto Island, Ontario, Canada.—The Department of Public Works has let contract for building rubble mound breakwater on brushwood fascine mattress in Lake Ontario to R. McDonald Company, Ltd., Crown Office building, Toronto. $201,840.

Wharf, Astoria, Oregon.—G. W. Sanborn Company let contract for building 500 foot wharf, 125 foot railway extension from railroad to pier head line, two 50x110 feet slips, 40x75 feet pier and warehouse to Hilpin Construction Company, Astoria. About $70,000.

Steamer Dock, Vancouver, Wash.—City having plans prepared for building first unit of new steamer dock, 964 feet frontage, concrete and steel with frame wood piling, including 100x500 foot warehouse. About $130,000. A. C. Shumway, Vancouver, engineer.

Terminal, Providence, R. I.—The Zenith Transportation Company has leased the north side of the State pier on Allen's avenue, Providence, and will make it a terminal for cargo steamers to and from the Atlantic Coast and European points. The company is a subsidiary of M. F. Donovan & Sons, 100 Broadway, New York.

Quay Reconstruction, The Clyde, England.—The trustees of the Clyde Navigation, Glasgow, Scotland, have awarded to Sir William Arrol & Company, Ltd., a contract for extending 375 lineal feet of quayage at the net cost of materials and wages plus £20,000 for all charges, use of plant, and commissions; total estimated cost £94,000.

Marine Railway, Portland, Oregon.—The construction of a marine railway to cost about $250,000, which will accommodate vessels 300 feet in length, has been determined upon by Supple & Martin, operating the former plant of the Columbia Engineering Works at Linnton. No definite plans have been decided as to when construction will begin.

Bulkhead Wharf, San Francisco, Calif.—State Board Harbor Commission, Ferry building, let contract for building wood pile and cement bulkhead wharf in front of pier 27, connecting existing bulkhead wharves at piers 25 and 29 and constructing pile wharf connecting piers 25 and 27 to Healy, Tibbits Construction Company, 9 Main street; $38,717. State furnishes creosoted piles and cement.

Port Improvements, Philippine Islands.—Consideration of the establishment of a free zone in Manila and the decision to issue $6,000,000 of Government bonds for port works improvement are important steps taken by the Philippine Legislature. Among contemplated improvements to Manila harbor are the construction of additional piers, the tunneling of the Pasig river, the construction of coal and oil depots, and the dredging of the harbor to a depth of forty feet.

Terminal Facilities, New York City.—Bills have been signed by Governor Smith, of New York, authorizing the City of New York to construct terminals and warehouses, and providing for the straightening of the Harlem Ship Canal. Murray Hulbert, Dock Commissioner, says that probably $35,000,000 will be spent within the next two years as an initial outlay, of which $25,000,000 will go toward the terminal and warehouse establishment at Stapleton, S. I., and $9,500,000 for the Harlem river improvement project.

GOVERNMENT WORK

Dredging, Cleveland, Ohio.—United States Engineer Office, Federal building, has let contract for dredging and removing wharf in Huron Harbor to Great Lakes Dredge & Dock company for $24,191.

Crane Runway, Washington, D. C.—Specification 4174. Bureau of Yards and Docks, Navy Department, receives bids for building on existing foundations about 213 tons structural steel to form extension to Gun Park crane runway at Navy Yard. About $4,400.

Preparing Plans.—Plans are being prepared and bids will be called for by U. S. Engineers' office, Washington, D. C., when ready, for constructing new pier and dredging Newport; specification 4090; alteration to marine railway, Rockaway, L. I., specification 4184.

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Steel Catamarans for Porto Rico.—The United States Engineer's Office, War Department, Washington, D. C., let contract for steel catamarans for dredging in San Juan harbor, Porto Rico, to Greenlie, Halliday & Company, 499 Water street, New York. About $46,000.

Tracks, Naval Drydock, South Boston, Mass.—Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids for completing track system around drydock for special heavy drydock crane, and standard railroad equipment, etc.; specification 4196; about $120,000; $10 deposit for plans, etc.

Navy Yard Improvements, Philadelphia, Pa.—The Navy Department, Washington, D. C., is arranging for additions and improvements at the League Island Navy Yard during the coming year. The estimated expenditures are placed at $17,268,360, and this amount has been incorporated in the naval bill is now written; $11,000,000 will be used for construction and repair work, $2,500,000 for steam engineering service, $780,000 for ordnance and $1,000,000 for supplies.

Dredging, Saybrook, Conn.—United States Engineering Office, Providence, R. I., will receive bids until June 7, for maintenance dredging on Saybrook Bar, at the mouth of the Connecticut river.

Dredging, Malden River, Mass.—The United States Engineer's Office, Custom House, Boston, will receive bids until June 10 for dredging in Malden River, Mass. Information on application.

Dredging, New Jersey.—United States Engineering Office, 39 Whitehall street, will have specifications made for maintenance dredging in Keyport harbor, Shrewsbury river and other places in New Jersey.

Dredging Channel, Gulfport, Miss.—Work on the Gulfport channel has been started according to Major R. S. Thomas, United States engineer, and shoal places between the pier and Beacon 19 will be cleaned out.

Rebuilding Quay Walls, Scotland.—Among a number of schemes of harbor improvements which the Clyde Trustees have on hand at present is the reconstruction of the quay walls which collapsed at two parts of the harbor. It has been agreed to construct the quay wall 10 feet further into the river.

SHIPPING DEVELOPMENTS

Steamship Service, Mobile, Ala.—The Isthmian Line service from Mobile was inaugurated by the sailing of the steamer Chickasaw City, of the United States Steel Corporation, on May 14.

The New England Maritime Corporation, of Boston, has changed its name to North Atlantic & Western Steamship Company, providing monthly freight service between Boston and Pacific Coast ports.

Steamship Line Sold, Montreal, Canada.—Canada Steamship Lines, Ltd., has sold the Quebec Steamship Company lines operating between New York and the West Indies, to Furness, Withy & Company, Ltd.

Steamship for Coal Trade, Charleston, S. C.—The fleet of vessels operated by the Clinchfield interests in the coal trade between Charleston and Cuba has been increased by the addition of the steamer Cotopaxi.

Barge Line, Troy, N. Y.—The barge Edna Schum was launched at Kingston for the Lighters' Transportation Company, of New York, which inaugurated a barge line between Troy, Albany and New York.

New Shipping Company, London, England.—The Urbs Shipping Company has been organized with a capital of £50,000 to carry on the business of shipowners, etc. Solicitor, M. W. Starling, 5-6 Great Winchester street, E. C.

Reconditioning Steamer.—The passenger steamer Powhatan, 10,831 tons, chartered by the Shipping Board to the International Bureau of Supplies, is to be reconditioned by the charterers at a cost estimated at $2,350,000.

Restricting Loans, England.—British bankers are restricting loans on new shipping enterprises. One Cardiff concern, which had relied on a 50 percent loan on a newly bought steamer, was informed by the bank that it would lend only 30 percent.

Belgium Buys Steamers.—Two more American built steamers, the Fire Island and Long Island, both of Philadelphia, have been sold and placed under the Belgian flag. The Fire Island has had its name changed to Ionie and the Long Island to Argentinier.

Buy Steamers, New York.—The Elder Steel Steamship Company, 50 Broad street, New York, paid the United States Shipping Board in full for two steamers, the West Catanace and the Deerfield, the latter a refrigerator. The total cost of both vessels was $4,500,000.

New Steamship Company, New York.—The Five-Continent Steamship Company, 2 and 4 Stone street, proposes to operate ships in a number of trades soon. Robert S. Wild is vice-president and general manager, Lief S. Erickson chartering manager, and J. B. Magill traffic manager.

Pleasure Steamer, Great Lakes.—The Canada Steamship Lines are building a pleasure steamer for the Great Lakes service which will be fireproof and have a speed of 18 knots. It is planned to carry moving picture theatres, a children's playground, dancing pavilion, terraced decks, and other novel features.

Buys More Ships, Baltimore, Md.—The Standard Steamship Company, of 26 Cortlandt street, and Baltimore, is buying additional tonnage from the Shipping Board. The company's president is Guert G. Jackson; vice-president, J. F. Hefferman; treasurer, J. D. Childs, and secretary, J. B. Murray.

Harbor Tugs Bought, Norfolk, Va.—Two new river tugs, the Fannabelle Stewart and the Alexander Stewart, of 10 and 20 tons respectively, have been purchased by the Stone Towing Company, Wilmington, N. C. This makes a fleet of nine boats operated by the company at this port and Wilmington, N. C.

New York-Oriental Service, New York.—The Dollar Steamship Line inaugurated a new service between New York and the Orient with the sailing of the Grace Dollar of 6,000 tons capacity, the first of the fleet of freighters assigned to the route. The New York offices of the company are at 44 Whitehall street.

Transportation Line, Greenport, L. I.—Business men and others of Greenport, Sag Harbor, and other Long Island ports, are planning a transportation service between the east end of Long Island and New York. It is announced that they will form a company with $100,000 capital for that purpose, if they cannot make other arrangements.

Atlantic-Pacific Coast Service, Boston.—The first steamship, the Artigas, of the new line between Boston and Philadelphia on the East Coast, and San Pedro, San Francisco, Portland and Seattle on the west sailed from Philadelphia May 15. Another ship is booked for June 15. On their return voyages the vessels will call at San Juan, Porto Rico.

Portugal-Japan Line, Portugal.—The ex-German steamers Bulow, Prinz Henrich, Mark and Koenig Albert have been placed by the Portuguese Government at the disposal of the new service between Portugal and Japan. Two other liners and six cargo vessels will also be placed on this service which will be fortnightly.

New Shipping Company, Cardiff, Wales.—The Dawson Line, Ltd., has been registered with a capital of £200,000 to carry on the business of ship and tug owners, shipbrokers, shipping agents, carriers by land and water, etc. Directors are D. S. Dawson, J. M. Collings, W. J. Powell, T. Howe, and F. Dawson, 64 Merchants Exchange.

New Shipping Company, Newcastle-on-Tyne, England.—The Joplin & Hull Shipping Company, Ltd., has been organized with a capital of £100,000 to carry on the business of shipowners, managers of shipping property, etc. Directors, F. W. C. Common, L. A. Common, W. Joplin, C. E. Hull, B. E. Common, 15 Queen street, Newcastle-on-Tyne.

Late Delivery, Scotland.—The Peninsular & Oriental liner Naldera, which was under construction at the Greenock Works of Caird & Company when the war began, has just been delivered. She has been successively a cargo carrier, auxiliary cruiser and seaplane carrier, and is now a liner. Her changes have increased her ultimate cost to £2,000,000.

New Line, Port Newark, N. J.—The Transmarine Corporation, a subsidiary of the Submarine Boat Corporation, starts its first steamer, the Italia, to Havana on June 1. Other ships built at the Submarine's yards will follow. All the cargo the steamer can carry was supplied as soon as the announcement was made. Space was limited on account of channel conditions.

South American Service, Seattle, Wash.—The Pacific-Argentine-Brazil Steamship Line has begun a freight service from Seattle, Wash., down the North and South American coast, steamers returning to Seattle by way of Punta Arenas and the east coast of South America through the Panama Canal, touching at the principal ports. The first steamer in the service was the Pallas.

Standard Oil Shipping Committee.—As a result of the growth of its fleet of oil tankers and the increase in that branch of the company's business, a special shipping committee has been formed by the Standard Oil Company, of New Jersey, to exercise supervision over construction, repairing, maintenance and operation. D. T. Warden, manager of the marine department, is chairman.

Liner to be sold, England.—The British Admiralty has put up for auction the old passenger liner Teutonic, which is probably destined for the scrap heap. Up to 1910 she was in the Southampton-New York run and then went to Montral up to the beginning of the war. The British Admiralty bought her from the White Star shortly after the opening of hostilities, transforming her into an auxiliary cruiser.

Steel Company & Ship Lines Merger, Montreal, Canada.—The Dominion Steel Corporation, the Nova Scotia Steel & Coal Company, Canada Steamship Lines, Ltd., and numerous smaller companies have merged into one large company which has secured a charter under the name of British Empire Steel Corporation, Ltd., with an authorized capital of $500,000,000, which it is expected will be doubled.

New Steamship Line, Seattle, Wash.—The General Steamship Corporation, of San Francisco, has been named the agents for the Java-Pacific Line, which will establish a sea service between Seattle and Java on the arrival at Seattle of the 10,000-ton steamship Bondowoso. The General Steamship Corporation recently received the berth from the Shipping Board from San Francisco and other coast ports for Australia and New Zealand.

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